The Strategic Decision Processes

and Information Needs of

Nuclear Government-Oversight-Agency Managers

by

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(ABSTRACT)

Nuclear government-oversight-agency (GOA) managers face increasing numbers of strategic decisions with fewer people to support their strategic decision processes. There is an increasing need to find new means of strategic decision support for nuclear GOA managers. This exploratory research contributes toward meeting this need by: (1) developing a set of contextual models of strategic decision making that link mental activities with information needs; (2) deriving a methodology to study the characteristics of the information needed by nuclear GOA managers when formulating strategic problems; and (3) demonstrating the methodology's use in drawing implications for designing decision tools.

The literature reviewed in the areas of management, strategic management, decision making, decision tools, and information characteristics formed the foundation for the development of three contextual models of individual, strategic decision making. The most detailed model, the Elementary Mental Activities Model, links the mental activities of strategic decision making with types of information, providing a perspective for strategic information.

An experiment was designed to engage nuclear GOA managers in realistic, strategic decision situations. Concurrent verbalizations yielded verbal protocols. Units of information used were identified according to the types of information--entities, attributes, values, relationships, and operators--in the Elementary Mental Activities Model.

Unique units of information were identified during coding. "Frequency of use" and "use" by subject and by exercise were calculated for each unit of information. The information characteristics source, level of detail, class, internal/external, and relationship complexity were assigned to entities, relationships, or operators.

Thirteen analyses of the data demonstrated the methodology's value for research in strategic decision processes, in strategic information, and in decision tools. All but one of the results were supported in the literature on strategic decision processes.

The research led to the following, overall conclusions.

1. The Elementary Mental Activities Model represents the information use of nuclear GOA managers engaged in strategic decision processes and characterizes their strategic decision processes in terms of information use.
2. The methodology developed is useful in measuring the information use of nuclear GOA managers engaged in strategic decision processes for the purposes of determining information needs for designing decision tools.

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TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 The Global Problem 2
1.1.1 Strategic Problems 4
1.1.2 Strategic Decisions 5
1.1.3 Manager's Characteristics 5
1.1.4 Manager's Strategic Decision Processes 6
1.1.5 Information 6
1.1.6 Decision Tools 7
1.1.7 Decision Environment 8
1.1.8 Research Paths 8
1.2 The Statement of the Problem 9
1.2.1 Subproblems 10
1.3 Research Objectives 10
1.4 Dissertation Overview 11

2.0 LITERATURE REVIEW 13
2.1 The Nature of Managerial Work 13
2.2 Decision Making Process 17
2.3 Strategy Work 19
2.3.1 Areas of Research Related to Strategy Work 19
2.3.2 Strategic Problems 22
2.3.3 Strategic Decisions 23
2.3.4 Strategic Problem Formulation 24
2.4 Strategic Decision Tools 28
2.4.1 Replicating and Reprogramming Versus Support 29
2.4.2 Supporting the Manager's Informational Roles 29
2.4.3 Supporting the Manager's Decisional Roles--Strategy Work 30
2.4.4 Group Strategic Problem Formulation Support 30
2.4.5 Computer-Based Support Systems for Top Managers 31
2.5 Strategic Information 32
2.6 Procedures for Studying Managers 33
2.7 Summary 35

3.0 RESEARCH CONCEPTS 36
3.1 The Nature of Nuclear Government Oversight Agencies 37
3.1.1 Distinguishing Characteristics of GOAs 38
3.1.2 Nuclear GOAs 39

3.1.3 Managerial Work of Nuclear GOAs 40
3.2 Context Model for Strategic Decision Making 41
3.2.1 Context Model Overview 41
3.2.2 Strategic Problems 44
3.2.3 Strategic Decisions, Information, and Decision Tools 45
3.2.4 Manager's Characteristics 45
3.2.5 Manager's Strategic Decision Processes 46
3.2.6 Importance of the Model 47
3.3 Mental Strategies 48
3.4 Elementary Mental Activities Model 50
3.4.1 Origins of the Elementary Mental Activities Model 50
3.4.2 Description of the Elementary Mental Activities Model 52
3.4.3 Importance of the Elementary Mental Activities Concept 56
3.5 Strategic Information 59

4.0 EXPERIMENT 63
4.1 Overview 64
4.2 Research Model 66
4.3 Verbal Protocols as the Primary Research Data 68
4.3.1 Concurrent Verbalization as the Primary Data Collection Instrument 68
4.3.2 Structured Interviews for Validity 70
4.4 The Laboratory Environment 70
4.5 The Subject's Experience and Personality 71
4.6 Strategic Problems 72
4.7 The Experiment 72
4.7.1 Script for the Experiment 72
4.7.2 Entrance Questionnaire 75
4.7.3 Laboratory Domain and Initial Status 78
4.7.4 Practice Strategic Exercise 78
4.7.5 Strategic Exercises 78
4.7.6 Structured Interview 83
4.7.7 Exit Questionnaire 83
4.8 Data Reduction 87
4.8.1 Transcribing 89
4.8.2 Translating 89
4.8.1 Coding 90
4.8.3 Verification 92
4.8.4 Unique Lists 92
4.8.5 Assigning Information Characteristics 94
4.8.6 Determining Usage of Units of Information 100
4.9 Databases and Tools 101

5.0 RESULTS AND SPECIFIC ANALYSES **102**
5.1 Overview 102
5.2 Analysis of Interview Data 102
5.2.1 Entrance Questionnaires 103
5.2.2 Structured Interviews 104
5.2.3 Exit Questionnaires 104
5.3 Analysis of Scenario Data 105
5.3.1 Number of Entities in the Scenarios 105
5.3.2 Entities Common to More than One Scenario 105
5.3.3 Level of Detail of Entities in the Scenarios 108
5.3.4 Class of Entities Used in the Scenarios 108
5.3.5 Internal/External Values of Entities Used in the Scenarios 108
5.4 Analysis of Coded Protocol Data 108
5.4.1 Analysis of Types of Information 112
5.4.2 Analysis of Characteristics of Entities 119
5.4.3 Analysis of Characteristics of Relationships 131
5.4.4 Analysis of Characteristics of Operators 134
5.4.5 Analysis of Protocols 137

6.0 ANALYSIS AND IMPLICATIONS **143**
6.1 Specific Analysis 143
6.1.1 Sample Population Analysis 143
6.1.2 Experiment and Methodology Analysis 144
6.1.3 Information Needs Analysis 146
6.1.4 Strategic Decision Processes Analysis 146
6.2 General Analysis 149
6.2.1 Assumptions of Generalization 149
6.2.2 General Management Conclusions and Implications 151
6.3 Summary Implications for the Research Concepts and the Methodology 154
6.4 Summary Implications for Strategic Decision Support 155
6.5 Deficiencies in the Research 156
6.6 General Research Conclusions 158

7.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS **160**
7.1 Summary of the Research 160
7.2 Summary Conclusions 168
7.3 Recommendations for Further Research 169
7.3.1 Use and Extend the Current Databases 169
7.3.2 Vary the Experimental Variables 170
7.3.3 Develop Better Distinctions for Strategic 171
7.3.4 Determine Causal Relationships 171

7.3.5 Use Information Boards 172
7.3.6 Develop Decision Tools 172

REFERENCES (Works Cited) 173

BIBLIOGRAPHY (Works not Cited) 181

APPENDIX A. ENTRANCE QUESTIONNAIRES 194

APPENDIX B. TRANSCRIPTS, TRANSLATIONS, AND CODED PROTOCOLS 203
B.1 Subject 1 203
B.1.1 Subject 1, Exercise 1 203
B.1.2 Subject 1, Exercise 2 205
B.1.3 Subject 1, Exercise 3 206
B.1.4 Subject 1, Exercise 4 209
B.1.5 Subject 1, Exercise 5 211
B.2 Subject 2 213
B.2.1 Subject 2, Exercise 1 213
B.2.2 Subject 2, Exercise 2 217
B.2.3 Subject 2, Exercise 3 221
B.2.4 Subject 2, Exercise 4 228
B.2.5 Subject 2, Exercise 5 233
B.3 Subject 3 240
B.3.1 Subject 3, Exercise 1 240
B.3.2 Subject 3, Exercise 2 248
B.3.3 Subject 3, Exercise 3 252
B.3.4 Subject 3, Exercise 4 258
B.3.5 Subject 3, Exercise 5 263
B.4 Subject 4 268
B.4.1 Subject 4, Exercise 1 268
B.4.2 Subject 4, Exercise 2 273
B.4.3 Subject 4, Exercise 3 277
B.4.4 Subject 4, Exercise 4 281
B.4.5 Subject 4, Exercise 5 283
B.5 Subject 5 287
B.5.1 Subject 5, Exercise 1 287
B.5.2 Subject 5, Exercise 2 289
B.5.3 Subject 5, Exercise 3 292
B.5.4 Subject 5, Exercise 4 295
B.5.5 Subject 5, Exercise 5 298

APPENDIX C. LISTS OF UNIQUE UNITS OF INFORMATION **301**
C.1 List of Unique Values 301
C.2 List of Unique Attributes 309
C.3 List of Unique Entities and Information Characteristics 314
C.4 List of Unique Relationships and Information Characterisitcs 322
C.5 List of Unique Operators and Information Characteristics 344

APPENDIX D. STRUCTURED INTERVIEWS **369**
D.1 Parts I and II of the Structured Interview 369
D.2 Part III, Question 3.1 384
D.3 Part III, Questions 3.2 and 3.3 393

APPENDIX E. EXIT QUESTIONNAIRES **394**

VITA **401**

LIST OF FIGURES

Figure 1. The Context Model Overview for Strategic Decision Making 3
Figure 2. The Decision Making Process Model 18
Figure 3. Information Characteristics from the Literature 34
Figure 4. The Strategic Decision Process Model 42
Figure 5. Mental Strategies 49
Figure 6. The Elementary Mental Activities of Strategic Decision Making 51
Figure 7. The Research Model 67
Figure 8. The Researcher's Script for the Experiment 73
Figure 9. The Researcher's Script for the Experiment (Continued) 74
Figure 10. The Entrance Questions 76
Figure 11. The Laboratory Domain and Initial Status Description 79
Figure 12. The Practice Exercise 80
Figure 13. Strategic Exercises 81
Figure 14. Strategic Exercises (Continued) 82
Figure 15. Part I and Part III of the Structured Interview Questions 84
Figure 16. Part II of the Structured Interview Questions 85
Figure 17. The Exit Questions 86
Figure 18. Portions of a Verbal Protocol from Strategic Exercise One 88
Figure 19. The Interrelatedness of Types of Information 93
Figure 20. Number of Entities in the Scenarios 106
Figure 21. Entities Common to More than One Scenario 107
Figure 22. Level of Detail of Entities in the Scenario 109
Figure 23. Class of Entities in the Scenarios 110
Figure 24. Internal/External Values of Entities in the Scenarios 111
Figure 25. Frequency of Use of Relationships and Operators 113
Figure 26. Use of Relationships and Operators 114
Figure 27. Common Entities in 4 and 5 out of 5 Exercises 116
Figure 28. Common Entities in 3 out of 5 Exercises 117
Figure 29. Common Entities in 2 out of 5 Exercises 118
Figure 30. Frequency of Use of Entities by Source 120
Figure 31. Use of Entities by Source 121
Figure 32. Frequency of Use of Entities by Level of Detail 122
Figure 33. Use of Entities by Level of Detail 123
Figure 34. Frequency of Use of Entities by Class 124
Figure 35. Use of Entities by Class 125
Figure 36. Frequency of Use of Entities by Internal/External 127
Figure 37. Use of Entities by Internal/External 128
Figure 38. Frequency of Use of Entities by Level of Detail, Class, and Internal/External 129
Figure 39. Use of Entities by Level of Detail, Class, and Internal/External 130

Figure 40. Frequency of Use of Relationships by Class 132
Figure 41. Frequency of Use of Relationships for Non-Assignment Classes by Internal/External 133
Figure 42. Frequency of Use of Relationships by Complexity 135
Figure 43. Frequency of Use of Operators by Class 136
Figure 44. Frequency of Use of Operators by Complexity 138
Figure 45. Protocol Relationship Complexity by Subject 140
Figure 46. Protocol Relationship Complexity by Subject (Continued) 141
Figure 47. Protocol Relationship Complexity by Subject (Continued) 142

LIST OF TABLES

Table 1. Key Literature 14
Table 2. The Framework of Information Characteristics: Manager Independent 60
Table 3. The Framework of Information Characteristics: Manager Dependent 61
Table 4. The Number of Sentences Coded and Units of Information in the Unique Lists 95
Table 5. Empirical Generalizations and Managerial Conclusions 147
Table 6. Managerial Conclusions and Supporting Literature 148
Table 7. The Number of Sentences Coded and Units of Information in the Unique Lists 162
Table 8. Empirical Generalizations and Managerial Conclusions 165
Table 9. List of Unique Values 302
Table 10. List of Unique Attributes 310
Table 11. List of Unique Entities With Assigned Values for Information Characterisitcs. 315
Table 12. List of Unique Relationships With Assigned Values for Information Characteristics 323
Table 13. List of Unique Operators With Assigned Values for Information Characteristics 345
Table 14. Subjects' Responses to Part I and Part II of the Structured Interview 370

1.0 INTRODUCTION

Over the past fifteen years the number of strategic decisions facing nuclear government-oversight-agency (GOA) managers has dramatically increased. What used to be tactical problems are now strategic problems for nuclear GOA managers. For instance, ten years ago an unexpected reactor outage was a major tactical problem; the main concern was having enough material to meet demand while restarting the reactor. Now, an unexpected reactor outage has become a strategic problem because the reactor may not be allowed to be restarted for unpredictable reasons that change with the course of events; and the resulting external outage could have unpredictable long-term effects on operations.

Nuclear GOA managers making strategic decisions rely heavily on experts to support them with information. In addition, the number of people in positions to support nuclear GOA managers making strategic decisions is decreasing. Many of these experts have worked for twenty or thirty years in the GOA and are retiring. Young people are not choosing careers with the nuclear industry and mid-level people working in the nuclear industry are leaving for other opportunities. This means when the experts retire, there will be fewer people to provide support for nuclear GOA managers.

Because of the increasing number and importance of strategic decisions and the decreasing number of support people, there is an urgent need to find new means of strategic decision support for nuclear GOA managers. An understanding of the processes nuclear GOA managers use to make strategic decisions and the characteristics of the information used to support decision making is required to design and build new means of strategic decision support.

This research focuses on individual managers and their individual, strategic decision processes as opposed to groups of managers or group, strategic decision processes. For simplicity, references to managers and strategic decision processes should be interpreted to be for individuals rather than groups.

First, the context of this research is presented in terms of the global problem in the world of research that needs further research to enable resolution of the real-world problems. Then the problem addressed in this research is presented along with the specific research objectives. Finally, an overview of the entire document is presented.

1.1 The Global Problem

The global problem this research addresses is that it is unclear how managers make strategic decisions. Many researchers have descriptive and prescriptive models of how the manager makes or should make strategic decisions in an organizational setting over long periods of time. However, few have focused on the manager's thought processes. Those researchers who have focused on the manager's thought processes have done so with the objective of understanding the manager's thinking rather than linking the manager's thinking with the information needed to support the manager's strategic decision processes.

Figure 1, *The Context Model Overview for Strategic Decision Making*, shows an overview of a context model for strategic decision making developed in this research and presented in more detail in Chapter 3.0, *Research Concepts*. This context model was adapted for strategic decision making from the Kurstedt et al. (1989) model of decision making. The context model shows a manager faced with strategic problems engaging in some mental activities called strategic decision processes that result in a strategic decision. The manager's characteristics, e.g., resources, intelligence, experience, personality, capability, etc., affect the nature of the strategic decision processes. For example, the manager's personality may affect what resources are used and how the resources are applied to result in the strategic decision processes used. The manager may use external support in the form of decision tools during the strategic decision processes. The manager requests information from the decision tools and/or provides information to the decision tools. The decision tools collect, store, manipulate, and provide information to the manager to support the manager's strategic decision processes. The environment for strategic decision making includes the manager's domain of responsibility and reality.

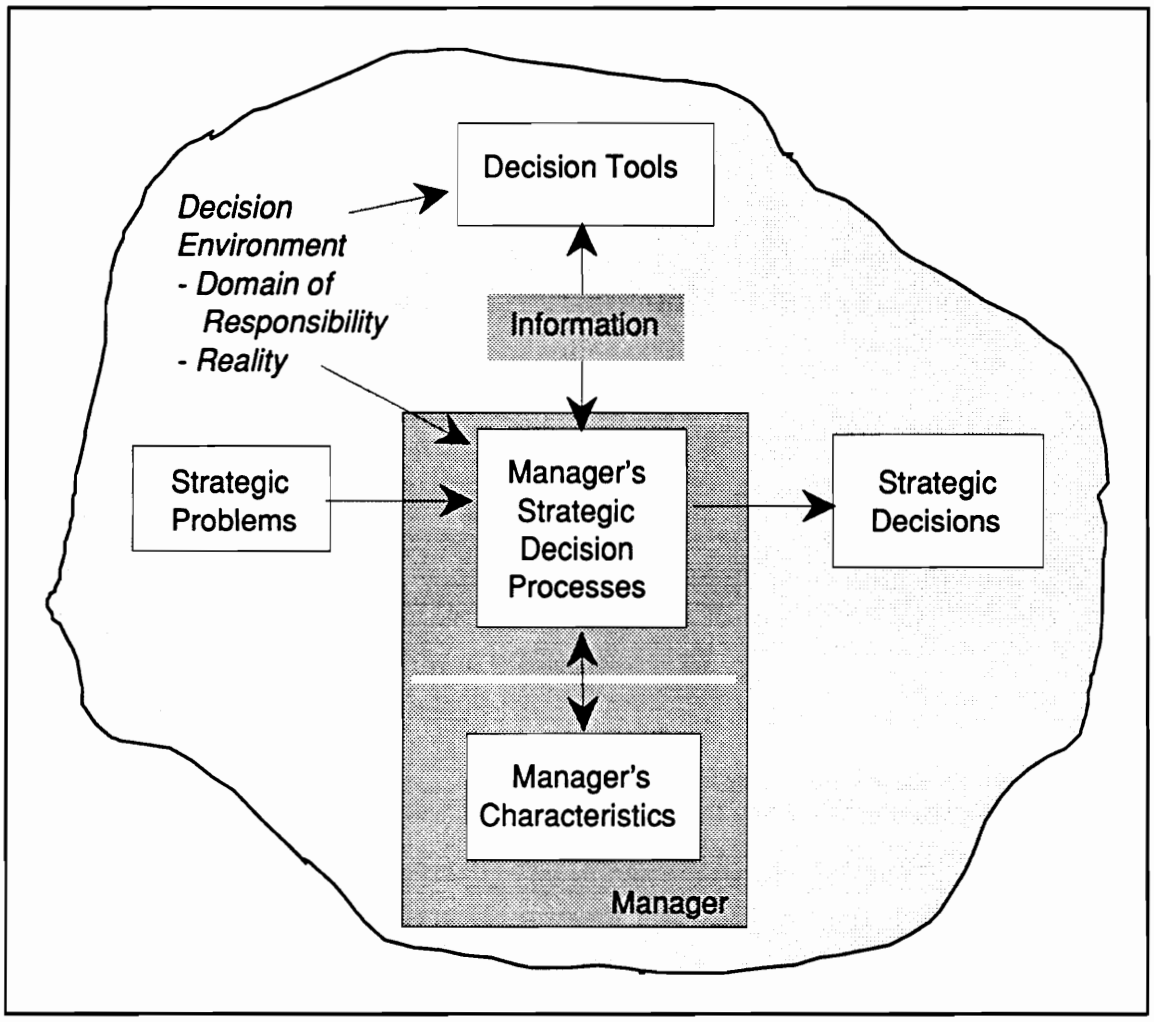


Figure 1. The Context Model Overview for Strategic Decision Making

The strategic decision making context model provides a systematic means to break the global problem into smaller, related problems. The following sections briefly describe what is known and what needs to be understood for each component of the context model in Figure 1, *The Context Model Overview for Strategic Decision Making*. What is known for each component is presented in more detail in Chapter 2.0, *Literature Review*. For some components, what needs to be known is part of this research. For other components, what needs to be known is posed for further research.

1.1.1 Strategic Problems

Strategic problems are situations which have or are perceived by the manager to have the real or potential effect of altering the global rules by which the manager's organization operates. The global rules, or strategies, are both explicit and implicit. Strategies are established and maintained in a variety of organizational documents and understandings such as the organization's corporate culture, goals and objectives, mission, and policies and procedures of operation.

The characteristics of strategic problems are well documented in the literature, e.g., Mason and Mitroff (1981). Many researchers agree on the general definitions for strategic problems and have contributed additional characteristics of strategic problems. For example, Mintzberg (1973) adopted these characteristics in his work which documented that strategic problems reach managers as units of information.

Some work exists on determining the effect of the characteristics of strategic problems on the decision processes. This area of research is known as strategic content research (Fahey & Christensen, 1986). This body of research is focused on strategic problems that are financial in nature, e.g., corporate acquisitions and market strategies, and examines organizational strategic decision making activities. There is a need for further research to understand how the nature of strategic problems affects the strategic decision processes of managers.

1.1.2 Strategic Decisions

Most of the literature on strategic decisions pertains to the processes by which strategic decisions are made. For clarity in this research, the processes used to make decisions are separated from the decisions themselves. Therefore the term decision is used to mean a choice. In the case of problem formulation, the decision is the choice of a particular formulation of the problem. A strategic decision is then a choice of strategy.

Organizations have deliberate (a priori) strategies and emergent (a posteriori) strategies (Mintzberg & Waters, 1985). This research focuses on deliberate strategies since they are the ones that result from conscious, strategic decision making. Deliberate strategies are represented by the organization's strategic plans, goals and objectives, policies, corporate culture, and other documents and understandings that prescribe how the organization should behave to serve it's environment. Emergent strategies describe how the organization behaved, which may differ from the prescription of deliberate strategies. What is not available, but needed, is a taxonomy of strategic decisions to allow study of the effects of the decision environment on the nature and frequency of strategic decisions.

1.1.3 Manager's Characteristics

There is a need to understand what and how the manager's characteristics affect strategic decision processes. There is a related need to understand how the manager's personality, experience, capability, and other characteristics affect the choice, application, and existence of strategic decision processes.

The literature demonstrates the manager's mental models (Piaget, 1974) and mental strategies (Simon, 1960) are key resources affecting the precise nature of the strategic decision processes used to make strategic decisions. The manager's experience (Ramaprasad & Mitroff, 1984) and personality (Kurstedt et al., 1989) affect the nature and choice of the manager's mental models and mental strategies.

1.1.4 Manager's Strategic Decision Processes

There is a need to determine the strategic decision process in enough detail to link the manager's strategic decision processes with the characteristics of information needs. There are no models of the strategic decision process that provide the level of understanding of information needs necessary to research decision tools to support manager's strategic decision making.

A distinction is made in this research between supporting managers with the information they need and use and supporting managers by replicating or reprogramming how they make strategic decisions. This research does not attempt to replicate or reprogram how managers make strategic decisions.

The body of literature on strategic decision processes has been recently reviewed by Huff and Reger (1987). This body of literature focuses primarily on organizational processes and group processes rather than the thinking processes of concern in this research. Process studies of people's thinking have grown out of the field of cognitive psychology (Piaget, 1974) into the research of the decision theorists (Simon, 1960; Newell & Simon, 1972). The decision theorists' works have focused on describing and replicating the decision making processes used for well-defined problems (Simon, 1987). Strategic decisions result principally from decision processes addressing strategic problems, which are typically ill-defined problems (Mason & Mitroff, 1981). Strategic decision processes involve judgment and intuition (Simon, 1987). A few researchers have linked the work of the decision theorists with strategic decision processes (Pounds, 1969; Ramaprasad & Mitroff, 1984), but have not focused on linking the strategic decision processes with the nature of information needs.

1.1.5 Information

The information needs of managers making strategic decisions need to be characterized in a manner useful for designing decision tools to provide information support to the managers.

A number of researchers have indicated the characteristics of information to support strategic decision making. Gorry and Scott Morton (1986) indicated strategic decision making requires more external information, a very wide scope of information, aggregate information, information about the future, and information that's low in accuracy. Mintzberg (1973) suggests managers making strategic decisions need current, trigger information and prefer verbal communication of that information. These statements are typical of the types of specifications found in the literature on the information needs for strategic decision support.

Designing and building decision tools to support strategic decision processes requires specifying information needs to a greater extent than has been done. For example, a support person providing information to the manager needs to know what external organizations to gather information about, what level of detail to go into, how far in the future to predict information, and how accurate the information needs to be, etc.

1.1.6 Decision Tools

There are two basic needs in the area of decision tools. First, the characteristics of decision tools to support strategic decision making need to be determined. Second, the effect of a variety of decision tools on the strategic decision processes of managers needs to be determined. Decision tools proposed to improve and/or support the strategic decision process should be developed and tested. Decision tools found valuable in group or organizational settings should be translated into equivalent decision tools for managers and tested to determine if they help the manager.

Many researchers have proposed decision tools to support managers in an organizational setting making strategic decisions. Mintzberg (1973) proposed supporting the manager by formalizing the manager's private information system and by developing managerial models for quick-and-dirty analyses. Many researchers have developed methods for improving group strategic decision making: developing taxonomies of problem types and problem approaches, aids for generating new ideas, devil's advocate and dialectic inquiry

techniques, and formal decision analysis (Schwenk & Thomas, 1983). Many of the group decision tools like devil's advocate and dialectic inquiry decision tools are based on prescriptive studies of strategic decision making and propose changing a manager's or an organization's approach to making strategic decisions.

1.1.7 Decision Environment

The characteristics of the decision environment important in strategic decision making need to be identified and related to the components. Peterson et al. (1986) proposed characterizing the manager's domain in terms of the level of uncertainty and related the different uncertainty levels to the amount of structure in the decision making processes. Similarly, more concepts relating variables, e.g., the amount of time allowed to make the decision, to their effect on the strategic decision processes need to be developed.

1.1.8 Research Paths

The preceding paragraphs identify a number of research efforts surrounding the context of strategic decision making. A number of paths of strategic decision making research could be taken depending on the purpose and direction of a group of research efforts. The different paths are determined by the variables the researcher holds constant and the variables the researcher varies and studies.

The paths start with adopting or developing a contextual model of the strategic decision processes. The nature of the contextual model depends on the research objectives and on the subsequent research efforts. For example, organizational behavior research adopts an organizational perspective of strategic decision processes while cognitive psychology tends to view mental strategic decision processes. Research efforts with the objective of prescribing the best approaches to decision making tend to adopt and develop rational problem-solving models of strategic decision processes. Descriptive research efforts begin by holding as many variables as possible constant to focus the research on uncovering the strategic decision processes for a given population of managers.

Once the concept of strategic decision processes has been developed for the population, there are two basic paths of study. First, the researcher could begin to study the effects of a component on the strategic decision processes by altering the component and characteristics of the component while holding the other components constant. Second, the researcher could begin to characterize information leading to specification and study of the decision tools. The second path is the direction of this research.

Within the second path of research there are choices to be made on the scope and direction of research efforts. The first research effort must involve the development of a concept of strategic decision processes that links the manager's strategic decision processes with the characteristics of information needs. The second research effort would then be to identify and characterize the nature of the information necessary to design the decision tools which would eventually provide the information to the manager. The third research effort would address the design criteria of decision tools to support strategic decision making. A choice in direction and scope within the study of the decision tools is whether to address a general characterization of all possible decision tools or focus on a particular class of decision tools, e.g., expert support, private information systems, and managerial models. The final research effort would then be to develop and apply the tools to measure their affect on the strategic decision processes.

This research is descriptive, exploratory research on strategic decision making. The contextual models are developed in this context with the objective to characterize information needs leading to the specification and study of decision tools.

1.2 The Statement of the Problem

Within the global problem stated on page one, the more specific problem addressed by this research is that nuclear government-oversight-agency managers need new means of decision support for strategic decision making. Given this problem, this research will address three subproblems.

1.2.1 Subproblems

1. A conceptual model of strategic decision processes needs to be developed that links nuclear GOA managers' mental activities with information needs.

2. The important characteristics of information necessary to support strategic decision processes need to be identified and operationally defined for nuclear GOA managers.

3. The decision tools capable of providing the information to support nuclear GOA managers' strategic decision processes need to be identified and related to the characteristics of information needs.

This research effort will address subproblems one and two and discuss the implications of the results of this research as they relate to subproblem three, the decision tools. Obtaining solutions to the first two subproblems establishes both a framework and an initial step toward solving the global problem stated above.

1.3 Research Objectives

Given the subproblems above, the objectives of this research are:

1. To develop a set of contextual models of strategic decision making that expands on the current theory and to propose the relationship between information and the manager's strategic decision processes,
2. To study the characteristics of the information needed by nuclear GOA managers when formulating strategic problems, and
3. To propose implications for designing decision tools based on the results of the study of the characteristics of information needs.

A set of contextual models is needed because there is a gap between (1) the theories describing managers approaching well-defined problems as information processors and (2) the theories of strategic decision processes. Strategic decision processes have been described in too general terms to provide insight as to the characteristics of information needs. The theories paralleling human problem solving with information

processing are too detailed and too focused on well-defined problems to be of direct value in constructing a general theory of information needs. The contextual models are developed using theories and concepts of past research reported in the literature principally in the areas of strategic management, human problem solving, cognitive psychology, artificial intelligence, and management.

The methodology developed to study the characteristics of information draws its theoretical foundation from the contextual models and provides empirical data to generate a substantiated concept of information needs. The characteristics of information are necessary to provide a foundation for the design and development of decision tools to support managers' strategic decision processes.

Objective two was accomplished by three subobjectives; (1) to develop a framework of information characteristics, (2) to develop an experiment to collect data to determine information needs, and (3) to develop methods for coding and analyzing the data from the experiment. The concept of information needs was developed first by deriving a framework information characteristics. Then an experiment was conducted to engage nuclear GOA managers in a series of strategic exercises involving strategic decision making. Concurrent task verbalization and structured interviews were used to collect data on the managers' strategic decision processes. Methods were developed to code the resulting verbal protocols and extract data describing the characteristics of the information needed. Through an iterative method of analysis, which is a characteristic of methods used in qualitative research, patterns in information needs were discovered and compared among managers to form a concept of information needs. With the concept of information needs in hand, implications were made concerning the decision tools needed to provide the information to support the managers' strategic decision processes.

1.4 Dissertation Overview

Chapter 1.0, *Introduction*, has provided an overview of this research presenting the need, the global problem, the specific problems to be addressed in this research, and the research objectives.

Chapter 2.0, *Literature Review*, presents a review of the theories and concepts in the literature which have provided the theoretical foundation for this research. The literature review begins by examining Mintzberg's (1973) findings on the nature of managerial work. The unique characteristics of nuclear GOA's and nuclear GOA managers' are compared to the nature of managerial work. Then the literature review focuses in more depth on the theories surrounding strategic decision making and the decision tools to support the managers strategic decision processes. The chapter concludes with the literature describing procedures for studying managers' strategic decision processes.

Chapter 3.0, *Research Concepts*, is a detailed presentation of the research concepts developed for this research. The set of contextual models for strategic decision making are presented. There are three, closely related contextual models developed for this research: the strategic decision making model, the mental strategies model, and the elementary mental activities model. In addition to the contextual models, the framework of information characteristics is presented in Chapter 3.0, *Research Concepts.*

Chapter 4.0, *Experiment*, presents the experiment as conducted and the data reduction procedures. The data generated in the experiment are presented in the Appendices.

Chapter 5.0, *Results and Specific Analyses*, presents the results of the data analyses and the interpretation of the results.

Chapter 6.0, *Analysis and Implications*, presents further analysis of the results of the experiment which lead to specific conclusions and implications for the research concepts developed, the methodology employed, and the decision tools needed to support strategic decision making.

Chapter 7.0, *Summary, Conclusions, and Recommendations*, presents a summary of the research, general conclusions, specific implications for decision tools, recognized deficiencies in the research, and recommendations for future research.

2.0 LITERATURE REVIEW

The body of literature surrounding managerial work and strategic management is extensive. However, the amount of literature dealing with strategic decision processes is limited. Table 1, *Key Literature*, shows the key literature for this research. This chapter presents the literature which provides the foundations for building the theoretical concepts necessary to study strategic decision processes specifically examining the characteristics of information needs. Some of the literature presented in Table 1, *Key Literature*, especially the literature pertaining to methods, is presented in various sections of the remaining chapters.

The review of the literature begins with the literature on what manager's do. Then past research efforts surrounding strategic decision processes are reviewed with emphasis on those efforts which state or imply links between mental activities and information. The review presents a summary of the literature on decision tools and the characteristics of information. The review concludes with a section describing procedures for studying managers.

2.1 The Nature of Managerial Work

In any research studying managerial work, one must arrive at a theory of the work managers do. In his book titled *The Nature of Managerial Work*, Mintzberg (1973) describes the schools of thought on managerial work. He begins with the "classical" school of thought founded by Fayol at the turn of the century. Fayol (1916) proposed that managers plan, organize, command, coordinate, and control. Researchers who accept the classical management concepts subscribe, to some degree, to Fayol's classification of what managers do. The "great man" school provides valuable reading for both the manager and the researcher by describing the great managers of history, but provides little theory on managerial work. The "entrepreneur" school is one of rational thinking in that the researchers ascribe a form of rational behavior to the manager. The "decision theory" school is led by the works of Herbert A. Simon and the Carnegie theorists, as Mintzberg calls them. This group of researchers views managerial activity solely as decision-making. Mintzberg identifies three schools of thought dealing with leadership: "leader effectiveness," "leader power," and "leader behavior."

Table 1. Key Literature

AUTHOR	FOCUS	DECISION MAKER... / GROUP	PROBLEM WELL- / ILL-DEFINED	DECISION STRATEGIC / OTHER	ORIENTATION PRESCRIPTIVE / DESCRIPTIVE
GENERAL MANAGEMENT					
Mintzberg (1973)	top-level managers activities	individual	both	both	descriptive
Anthony (1965)	managers' activities	individual	both	both	prescriptive
Kurstedt (1990)	managers' activities	individual	both	both	prescriptive
Simon (1960)	managers' thinking	individual	both	both	prescriptive
Gorry & Scott Morton (1986)	relates Simon and Anthony	individual	both	both	prescriptive
DECISION PROCESSES					
Simon (1960, 1987)	phases of decision making & role of intuition & judgement.	individual	both	strategic	both
Miller, et al. (1960)	decision processes	individual	well-defined	other	prescriptive
Piaget (1974)	learning	individual	both	other	descriptive
Newell & Simon (1972)	problem solving as information processing	individual	well-defined	other	descriptive
Ramaprasad & Mitroff (1984)	applies Piaget's theories to strategic DM	individual	ill-defined	strategic	prescriptive
Pounds (1969)	relates Simon and Miller et al. to strategic	individual	ill-defined	strategic	descriptive
Kurstedt, et al. (1989)	decision making model	individual	well-defined	other	prescriptive
Mintzberg et al. (1976)	group decision making processes	group	ill-defined	strategic	descriptive
Mason & Mitroff (1981)	group decision and support processes	group	ill-defined	strategic	prescriptive
DECISION TOOLS					
Gorry (1971)	development of managerial models	individual	ill-defined	strategic	-
Schwenk & Thomas (1983b)	categorization of decision aids	both	ill-defined	strategic	-
Rockart & Treacy (1982)	effects of computer-based CEO support	individual	both	both	descriptive
Falkenhainer & Forbus (1988)	qualitative physics models of steam plants	individual	both	both	-
Treacy (1986)	categorization of problem and information support	individual	both	both	-
Keen & Wagner (1979)	Mintzberg's work into computer support	group	both	both	prescriptive
INFORMATION (See Figure 3 for a more comprehensive list.)					
Gorry & Scott Morton (1986)	information needs by decision nature	individual	both	both	prescriptive
Peterson (1977)	types of information	-	-	-	-
Bender (1983)	entity-relationship information types	-	-	-	-
METHODS					
Mintzberg (1983)	direct research	-	-	-	descriptive
Mintzberg (1973)	top-level managers activities	individual	both	both	descriptive
Newell & Simon (1972)	replicating human problem solving	individual	well-defined	other	descriptive
Ericsson & Simon (1980, 1983)	verbal protocols as data	individual	-	-	descriptive
Ford, et al. (1989)	classification of methods for process tracing	individual	-	-	descriptive
Payne (1976)	methods for process tracing	individual	-	-	descriptive
Greenwell (1988)	protocol coding for artificial intelligence	individual	-	-	descriptive

These all deal with the interpersonal relationships of the managers with their followers. The final school of study is the "work activity" school. This is where Mintzberg fits. The researchers in this school are engaged in descriptive research of the manager to find out what he does rather than, as in the classical school, prescribe what the manager should do.

Mintzberg uses findings from many of these schools to support and to generalize his theory of managerial work derived from empirical research. Kurke and Aldrich (1983) confirmed Mintzberg's findings. Mintzberg's theory is cast in ten managerial roles to describe what managers do. Briefly, they are:

INTERPERSONAL ROLES:

1. Figurehead: The manager is a symbol of the organization he heads and must carry out a number of social, inspirational, legal, and ceremonial duties.
2. Leader: Like the leader schools of thought, this focuses on the manager's interpersonal relationships with his subordinates and the activities he must engage in to develop and maintain those relationships.
3. Liaison: This is the role the manager must play between people outside his organization and the people inside his organization.

INFORMATIONAL ROLES:

4. Monitor: The manager constantly monitors both his organization and his environment to build bits and pieces of data to direct the organization.
5. Disseminator: The manager has data and information no other person in the organization has. As such, he disseminates certain, privileged information.
6. Spokesman: When the manager transmits data and information outside the organization, he's acting as the spokesman for the organization.

DECISIONAL ROLES:

Mintzberg says the manager's decisional roles all involve strategy work (Mintzberg, 1973, p. 77).

7. Entrepreneur: The manager initiates controlled change in his organization to seize opportunities.
8. Disturbance Handler: The manager is the generalist, problem solver of the events threatening to disturb organization performance.

9. Resource Allocator: The manager oversees the organization's resource allocation, maintaining control of its strategy-making process.
10. Negotiator: A distinct form of decision role, the manager takes charge when the organization is engaged in important negotiations with an outside organization. (Mintzberg, 1973, pp. 167-169)

Kurstedt (1990a) takes a broader view of managerial work in his paper on endeavors. He distinguishes four levels of endeavors: strategic, tactical, operational, and clerical. Kurstedt (1990a) points out top managers not only do strategy work like deciding to change the organization's culture, but they do all levels of work to some degree, even clerical work like dialing the telephone. Kurstedt's (1990a) work progresses from Anthony (1965) and Gorry and Scott Morton (1986). Anthony (1965) progressed Fayol's (1916) classical concepts to account for shortcomings in the ability to measure the nature of managerial work. Anthony's (1965) work resulted in a framework of three major categories of work: strategic planning, management control, and operational control. Gorry and Scott Morton (1986) combined the concepts from Anthony (1965) with the decision school concepts of Simon (1960) to form a new framework for decision making. Even though Mintzberg observed managers opening their mail or dialing the telephone, he chose not to report on these types of managerial activities. Mintzberg also studied only the managers considered to be the chief executives of the organization (Mintzberg, 1973, p. 237). Therefore, Mintzberg's study focused on the distinguishing work of top managers.

In summary, managers do a wide variety of things from dialing their own telephone to forming the organization's strategy. Because of the direction of this research, the remainder of this literature review will address the distinguishing managerial activities of top managers. This includes Mintzberg's interpersonal, informational, and decisional managerial roles and Kurstedt's strategic endeavors.

2.2 Decision Making Process

Kurstedt et al. (1989) propose a model for decision making that's useful for understanding this research. Figure 2, *The Decision Making Process Model*, shows the model with its four components. The problem, manager, and decision components are essential for all decision making. This is consistent with Gorry's (1971) model where he shows only one component, the manager, with information as input and decisions as output. The decision tools component is considered an auxiliary component.

Kurstedt et al. divide the problem component into two subcomponents: decision task and constraints. Decision task is further divided into a question (or series of questions) and a set of available information external to the decision maker. Comparing this with Gorry's model, the question, information, and constraints are all information input to the manager. Another point worth noting is the Kurstedt et al. model makes the components of the problem explicit. In the real world, one piece of information might trigger the manager to realize there is a problem. Representing such a case in the Kurstedt et al. model might indicate the question, set of information, and constraints are sometimes implicit in the initial presentation of the problem to the manager.

Managers are complex and there exist a number of ways to view a manager as a component in a process. Kurstedt et al. emphasize two subcomponents: resources and personality. The resources include knowledge, experience, ability, and intelligence. Kurstedt et al. say the manager's personality "determines how the (manager) uses the resources" (Kurstedt, et al., 1989, p. 59).

"The decision component contains a plan of action designed to answer the question or questions set forth in the task" (Kurstedt, et al., 1989, p. 59). It's not clear in the literature what is a decision and what is the result of a decision. Webster's (1989) definition includes the word "the act or process" which would indicate a decision is a process. Kurstedt et al. use the term as a "plan of action" which results from a process.

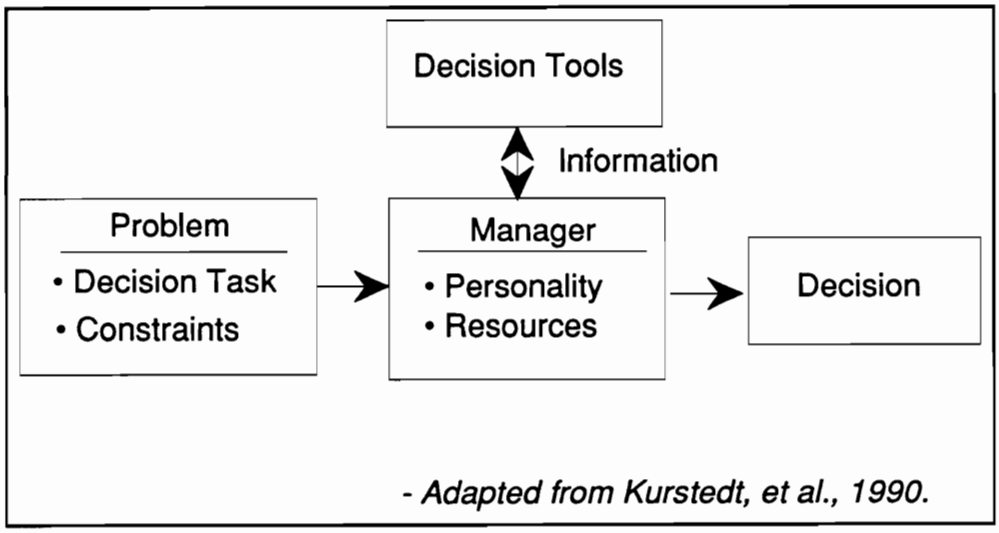


Figure 2. The Decision Making Process Model

The decision tools component may or may not be used by the decision maker. The decision tools consist of devices external to the manager, used to manipulate or store data and information to support the manager. The decision tools might include a wide range of tools from pencil and paper to sophisticated computer models for cost-benefit analysis. The decision tools also might include people: experts, analysts, and information coordinators who support the manager.

Information constitutes the interface between the manager and the decision tools. The manager may request information of and/or provide information to the decision tools. The decision tools provide information to the manager.

2.3 Strategy Work

The purpose of this section of the literature review is to gain a deeper understanding of the research on what managers do when they deal with strategic problems. Section 2.3.1, *Areas of Research Related to Strategy Work*, overviews the different areas of research that relate to strategy work. Then for each necessary component in the decision making process model, the research on strategy work is related. This section reviews only the components necessary for strategy work: problem, decision, and manager. The decision tools component and information interface are discussed in section 2.4, *Strategic Decision Tools*, and section 2.5, *Strategic Information.*

2.3.1 Areas of Research Related to Strategy Work

Ramaprasad and Mitroff point out that strategy work "has been conceptualized as an process, a group process, an organizational process, and as a combination of the three" (Ramaprasad & Mitroff, 1984, p. 597). Huff and Reger (1987) categorize research on strategic processes into descriptive research (those studies seeking to

describe what happens) and prescriptive research (those studies seeking to describe what should happen). Because of the direction of this research, this review focuses on the literature pertaining to descriptive studies of strategy work with emphasis on managerial decision-making.

There is an extensive amount of literature focused on strategic decision making. Nearly all of this research focuses on describing or prescribing organizational strategy work or the work of managers within organizations. Mintzberg et al. classify the descriptive studies into three groups: "research by cognitive psychologists on decision making in game situations, research by social psychologists on group decision making in the laboratory, and research by management theorists and political scientists on organizational decision making in the field" (Mintzberg et al., 1976, pp. 246-247). The group with the most potential value for this research is cognitive psychologists.

To study strategy work, the researcher must study the manager's thinking. The degree to which the researcher must capture the manager's thinking depends on the purpose of the research. Studies of managerial thinking are born in the area of cognitive psychology (Piaget, 1974; Minsky, 1986). The primary purpose of these studies was to understand how people think and learn with the objective of helping them learn to think better.

There are a number of areas of research which have been spawned from cognitive psychology, taking the perspective of the manager as primary. The area of mental models is focused on formalizing and comparing the mental models of experts and novices with the purpose of teaching novices to become experts (Gentner & Stevens, 1983). Commonsense reasoning is a closely related field of research which seeks to understand how people reason about common, physical things (Hobbs & Moore, 1985; Kuipers, 1984). The purpose here is to replicate this human reasoning to enable machines to do simple, commonsense tasks.

The areas of mental models and commonsense reasoning rely heavily on the results of other areas of research to enable them to represent human reasoning about physical phenomena. The other areas of research; artificial intelligence, mathematics of logic, qualitative physics, naive physics, and analogical modeling; provide the tools for research. The research into expert systems of artificial intelligence has demonstrated the feasibility and methods of capturing and replicating, in machines, human reasoning about specific tasks (Cross, 1988; Schoen & Sykes, 1987; Waterman, 1986; Forsyth, 1984; Barr & Fiegenbaum, 1982). Extensive use and

development of mathematical languages like predicate calculus has been used to enable researchers to represent human reasoning (Lemmon, 1978; Little, 1970; Lenat, 1982; Davis, Rosenschein, & Shapiro, 1982; Cohn, 1983).

Qualitative physics has grown out of a need to represent physical phenomenon accurately, but simply, to provide managers with structural models that provide answers more quickly than precise mathematical representations. Representative of the advances in qualitative physics is Falkenhainer and Forbus's (1988) work on setting up large-scale qualitative models. The goal of qualitative physics is "to develop systematic models that capture the breadth and depth of human reasoning about the physical world" (Falkenhainer & Forbus, 1988, p. 301). Naive physics is similar to qualitative physics in its goal of simplicity (Hayes, 1979). Naive physics is focused on capturing the reasoning humans use to represent physical phenomena, whereas, qualitative physics is focused on accurately representing physical phenomena in a manner similar to human reasoning.

Analogical modeling explores the representation of physical phenomena in terms of analogies or metaphors. For example, Gardin and Meltzer (1989) have represented water flowing from a glass onto a table using the behavior of pixels on a computer screen as analogous to molecules of water. In doing so, they've been able to replicate the behavior of the physical phenomenon relatively easily, whereas solving the set of non-linear partial differential equations to describe the phenomena is extremely difficult for anything but mathematically simple boundary conditions.

The decision theorists have focused on understanding in enough detail to show how people make decisions so decision making can be replicated (Newell & Simon, 1972). The decision theorists have progressed from studying people making structured decisions to begin to theorize about how people deal with unstructured decisions, i.e., decisions involving judgement, (Kaplan & Schwartz, 1975; Simon, 1987) and about how people deal with uncertainty in making decisions (Hink & Woods, 1987). Still the direction of the decision theorists' work is to replicate the decision making process and not to capture what information and characteristics of information are necessary to make decisions.

In only a few cases have researchers concerned with strategic management focused on strategy work in terms of how managers think about strategic problems, i.e., what mental processes they use, and arrive at strategic decisions. Most are concerned with the nature of the manager's work within the organization over long periods of time. Note that this research focuses on the manager's thinking in short periods of time. The few who've related the work of the cognitive psychologists and decision theorists to strategic work in descriptive research contexts are reviewed in the following sections along with pertinent findings from the research areas above.

2.3.2 Strategic Problems

Marvin Minsky (1986) says a manager recognizes a problem or opportunity by using a difference-engine in his or her head. The difference engine detects differences between the description of the goal and the actual situation. The difference engine triggers different agents depending on the nature of the differences detected. If the differences seem to indicate a negative impact on the manager's operation, the differences represent a problem. If the differences indicate a positive impact, then they represent an opportunity. This research addresses these differences as problems recognizing they could be opportunities as well.

Mason and Mitroff (1981) provide an excellent discussion of the characteristics of strategic problems. They conclude, based on their work and the work of others (Rittel, 1972; Weaver, 1948), six characteristics of strategic problems. They are:

1. Interconnectedness: Every strategic problem is linked to every other strategic problem.
2. Complicatedness: Strategic problems have numerous important elements with relationships among them that include feedback loops which can magnify or cancel changes.
3. Uncertainty: Strategic problems exist in a dynamic, uncertain environment.
4. Ambiguity: Strategic problems can be seen in different ways depending on personal perspectives and there is no single correct view.
5. Conflict: There are competing claims in strategic problems with a need to trade off "goods" against "bads".

6. Societal Constraints: Social, organizational, and political constraints and capabilities are central to the feasibility and choice of solutions. (Mason & Mitroff, 1981, pp. 12-13).

Mason and Mitroff (1981) call strategic problems "problems of organized complexity." This means strategic problems contain a large number of variables that are tightly connected. These characteristics stress the importance of and need for problem formulation. Ramaprasad and Mitroff (1984) substantiate this by referencing a number of insights in the nature of strategic problems. Strategic problems have no unique, universal formulation. Different formulations result in different solutions to the same problem. Errors in formulation can result in solving the wrong problem and possibly compound the problem. (Ramaprasad & Mitroff, 1984, p. 597).

Mintzberg's work provides insight on how managers find problems (or opportunities). His representation is not unlike Minsky's description of the difference-engine. Mintzberg says a manager identifies decision situations with specific units of information as opposed to being presented with a comprehensive set of information (Mintzberg, 1975, p. 52).

Translating this description into the Kurstedt et. al. model indicates the manager is presented units of information (either proactively from seeking information or reactively by being presented information). It is then up to the manager to interpret the units of information as a problem (or opportunity) and to determine the question and the constraints that might apply.

2.3.3 Strategic Decisions

Mintzberg defines strategy as "a pattern in a stream of decisions" (Mintzberg, 1978, p. 935). In discussing the choice of definitions for the term strategy, Mintzberg points out there are two types of strategy: a priori and a posteriori. In a later paper, Mintzberg terms a priori strategy as deliberate strategy and a posteriori strategy as emergent strategy (Mintzberg & Waters, 1985). Deliberate strategy is the more classical view of strategy

consistent with Chandler's definition "... the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals" (Chandler, 1962, p. 13).

Game theory (Mintzberg, 1978) provides a concise picture for understanding deliberate and emergent strategies. In game theory, strategy is the rules by which the game is played. For example, the instructions that come with a set of checkers include the official rules of the game--the deliberate strategy. Often when two people play the game of checkers, they don't follow the official rules. They tend to make up their own rules, especially if the two people are young. The rules they actually play by are the emergent strategy (Mintzberg & Waters, 1985). The same is true for an organization. The organization's policies, culture, and other documents and understandings contain the deliberate strategy. The individuals in the organizations, however, tend to veer from the policies and make up their own rules as they go along (emergent strategy). This review focuses on strategy as deliberate strategy, and strategic decisions as decisions which affect deliberate strategy because this is typically the role of managers in strategy work.

2.3.4 Strategic Problem Formulation

In reviewing the areas of research overviewed in section 2.3.1, *Areas of Research Related to Strategy Work*, this researcher did not found any descriptive (or prescriptive) research that provided a suitable theoretical concept of strategic problem formulation for this research. A suitable theoretical concept would describe the manager's thinking when dealing with strategic problems and relate this thinking to information in the right detail to be useful for understanding how to support the manager by engineering decision tools. The decision theorists and expert systems researchers have replicated the mental processes for managers dealing with well-defined, narrow problems. As Newell and Simon (1972) clearly state, each case of replication stands only for that manager and that task. Generalization to other managers or other tasks is inappropriate. On the other hand, there are the researchers in cognitive psychology who are more interested in the manager's thinking processes and refer to information in very general terms, such as reality.

In the following sections the literature which lays the foundation for development of theoretical concepts of strategic problem formulation suitable for this research is presented.

2.3.4.1 Strategic Problem Formulation Versus Implementation

Andrews (1971) proposed a division between strategic problem formulation which is the process(es) by which decisions are generated and strategy implementation which is the process(es) by which decisions are put into action. There are several terms used to label these two divisions. Some, like Pounds (1969), use the term problem solving to include portions of formulation and all of implementation. Here, some of Pounds' problem solving steps will be included within problem formulation to remain consistent with the division between formulation and implementation. For clarity, this research will follow Andrews' distinction.

2.3.4.2 Simon's Phases of Decision Making

Herbert A. Simon (1960) proposed three activities in decision making:

1. Intelligence: searching the environment for conditions calling for decision.
2. Design: inventing, developing, and analyzing possible courses of action.
3. Choice: selecting a course of action.

Simon individually groups these activities into single activity phases suggesting a simple sequence of intelligence, design, and choice. Simon also recognized this to be a simplistic view. He suggests, for example, that an alternative generated in the design phase might require new intelligence activities.

Simon's phases of decision making are rational and prescriptive. The empirical research of Mintzberg et al. (1976) of twenty-five strategic decisions in organizations confirms Simon's phases. The Mintzberg et al. descriptive model has seven components grouped into three phases: identification, development, and selection. The activities in Mintzberg et al.'s model support Simon's distinction of three phases.

2.3.4.3 Pounds' Model of Strategic Problem Formulation

William Pounds (1969) provides a theory of strategic problem formulation that lays the ground work for developing a theory relating information to mental efforts. Pounds interviewed, observed, and interrogated fifty executives in a large, technically based company. He took the findings of his study and related them to the cognitive psychology based research of Simon (1960) and Miller et al. (1960). As a result, Pounds related what managers do with the theories of how managers think.

Pounds (1969) uses the term operators in his model of strategic problem formulation. He defines operator as managerial activities which transform a set of inputs into a set of outputs according to some plan. the term operator is useful to this research to distinguish the managerial activities contemplated during strategic problem formulation (operators) with the managerial activities of strategic problem formulation.

Pounds (1969) says managers have conceptual models of their operation and their environment. These conceptual models are in their minds. The manager uses the models to predict outcomes. The manager then compares the predicted outcomes with reality. If there are differences, the manager identifies the differences and selects a difference, which Pounds says, is the problem. These activities Pounds labels problem finding which is very similar to Minsky's (1986) difference-engine. Pounds continues describing the process by saying the manager then considers alternative operators. The manager then evaluates the consequences of the alternative operators and selects an operator.

The information needed by the manager is just under the surface of Pounds strategic problem formulation process.Words like "reality" and "predicted outcomes" imply the information needed to support the manager.

2.3.4.4 Mental Models and Strategic Problem Formulation

Consistent in many areas of published research is the notion the managers have and use mental models (Piaget, 1974; Minsky, 1986; and Newell & Simon, 1972). There is an area of psychology devoted to the study of mental models (Gentner and Stevens, 1983). Mintzberg (1973) relates the manager's mental models with the decisional roles of managerial work in that managers use mental models to make decisions.

Ramaprasad and Mitroff (1984) use Piaget's (1974) theories of understanding causality to derive a perspective of strategic problem formulation based on the development of mental models. Piaget's theory centers around the existence and development of logico-mathematical structures to understand cause and effect relationships in reality. Ramaprasad and Mitroff believe the only difference between geometry problems and strategic problems is there are no generally accepted logico-mathematical structures (LMSs) for formulating strategic problems. Therefore, for each strategic problem a manager faces, the manager must develop a unique LMS.

Piaget's concept of an LMS doesn't equate directly with a mental model (Piaget, 1974). An LMS is a set of established rules used to formulate problems. The formulation of a problem using the LMS (or rules) results in a mental model of the perceived problem in reality. Therefore, the development of the LMS results in the development of a mental model of reality. So for the purposes of this research, it suffices to substitute mental model for LMS in Ramaprasad and Mitroff's (1984) model of strategic problem. formulation.

The initial mental model is simple and more than likely a previously developed model for what the manager perceives is a similar problem. The manager then obtains information about a phenomenon through simple abstraction--observation and perception. The data the manager collects are tested against the deductions of the mental model in a process very much like hypothesis testing called application. If there are differences, reflexive abstraction, the process of induction, is used to modify the mental model. The sequence is repeated until the manager is satisfied the mental model adequately explains the phenomenon. When this is the case, attribution occurs in that the mental model becomes reality for the manager.

2.3.4.5 Mental Strategies

Kurstedt et al. (1989) developed the decision making process model presented in Figure 2, *The Decision Making Process Model*, to study the selection of decision strategies. Decision strategies are the approaches managers use to work through a problem to result in a decision. The decision strategies discussed by Kurstedt et al. are strategies used by people to compare alternative solutions, with the final decision being the selection of one of the alternative solutions.

Mintzberg (1973), when commenting on Simon's (1960) unprogrammed decisions, says it might be that strategic decisions which appear unprogrammed, "may in fact be using higher-order programs--a program to define problems, a program to search for alternatives, a program to make choices" (Mintzberg, 1973, p. 15). Following Mintzberg's suggestion, these higher-order programs would then be the decision strategies. Pounds (1969) confirms this when he refers to Simon's (1960) three phases (intelligence, design, and choice) as classes of decision rules. Decision rules are the rules which managers use to make decisions. This concept of decision rules fits nicely with the concept of strategy as rules by which decisions are made. Therefore, the manager uses decision strategies to make decisions about strategies for the organization, and according to Pounds (1969), managers use three classes of decision strategies: intelligence strategies, design strategies, and choice strategies.

2.4 Strategic Decision Tools

Mintzberg (1973) points to several areas where management scientists and others who seek to support managers can focus their efforts. There are a number of people working to support managers. First there is his staff and direct subordinates--the functional organization. Then there are the people Mintzberg refers to as management scientists--those who study the manager's work and try to develop systems to improve and support the manager's performance. This research serves to develop management support tools.

This review only addresses the strategic decision making process and not the means of supporting the manager by affecting the environment for decision making, e.g., providing a quiet place to think through decisions. Therefore, decision tools and their functions of storing, manipulating, and providing information to the manager as described by Kurstedt et al. (1989) will be discussed here.

2.4.1 Replicating and Reprogramming Versus Support

Newell and Simon (1972) demonstrate replicating human problem solving with information processing systems. The entire field of expert systems and much of the work of the decision theorists is dedicated to replicating expert problem solving. This research does not propose to replicate strategic problem formulation.

Mintzberg (1973) writes extensively about the concept of programming and reprogramming managerial work. The idea is to improve the manager's performance by improving how the manager performs certain managerial tasks. The analyst must follow basically the path of Taylor (1947) to (1) describe the manager's work as a sequence of steps toward an end (a program), (2) analyze the program to understand its content and purpose, (3) enhance the program systematically by removing unnecessary steps, and (4) reprogram the manager with the more efficient program to gain managerial improvement.

Both replicating and reprogramming imply changing what or how the manager formulates strategic problems. Underlying both efforts is the assumption the researcher understands the manager's business better than the manager and understands the manager's thinking processes well enough to improve them. Neither is within the grasp of today's state-of-the-art research nor within the scope of this research.

On the other hand, support means understanding enough about the manager's business and thinking processes to provide better information to help the manager rather than change the manager.

2.4.2 Supporting the Manager's Informational Roles

To support the manager in his informational roles, Mintzberg (1973) suggests we can be most helpful by establishing a more efficient scanning activity to find current, trigger information the manager wants. We can also begin to formalize the information the manager maintains in his head and transfer it into a more accessible data base. Having this privileged information in a form outside the manager's head would enable the manager to establish rules for disseminating the information to others in his organization. This, Mintzberg suggests, would help with all three information roles.

2.4.3 Supporting the Manager's Decisional Roles--Strategy Work

Mintzberg (1973) proposes seven areas where the manager and analyst can cooperate to support managerial roles:

1. Opportunity and Problem Finding: This relates to analyst's support of the informational roles.
2. Cost-Benefit Analysis: Developing methods for evaluating alternative solutions to strategy problems.
3. Model Building: Mintzberg suggests two types of activity in addition to the models needed for cost-benefit analyses; (a) models to simulate explicitly some situations managers must face, and (b) models to expose managers systematically to the best available conceptual understandings of reality, like how his consumers behave. The main purpose of the second type of models is the manager will develop models of these things in his head anyway and "by explicit focus on them, the (analyst) can help ensure that the models (the manager uses) are the best ones possible" (Mintzberg, 1973, p. 158).
4. Contingency Planning: Up-front planning of alternatives.
5. Real-time Analysis: "With a thorough understanding of the manager's environment and the ability to act quickly, the analyst would be able to apply his analytical approach to help the manager under pressure. He would be prepared to forecast with simple mathematics, to conduct brief market research studies without concern for statistical validation, and to perform quick cost-benefit calculations using only a few alternatives and rough estimates" (Mintzberg, 1973, p. 159).
6. Project Monitoring: Providing status information on the manager's new initiatives.
7. Adaptive Planning: An integrated plan of improvement projects.

2.4.4 Group Strategic Problem Formulation Support

The research of decision support for groups formulating strategic problems has promoted several methods of proven support. It might be possible to transfer or translate these methods into methods for strategic problem formulation support. Schwenk and Thomas (1983) review the methods of group support in four classes:

1. Matching of problem to problem types approach: developing taxonomies of problem types and problem approaches to enhance learning.

2. Creative stimulants--aids for generating new ideas: brainstorming, synectics, morphological analysis, Delphi procedure, and scenario construction.
3. Devil's advocate and dialectic inquiry: generation of conflict, identifying assumptions, and challenging assumptions.
4. Decision analysis as a stimulus for policy dialogue: formal decision analysis.

Schwenk and Thomas's classification covers the range of group support reported in the literature.

2.4.5 Computer-Based Support Systems for Top Managers

Treacy (1986) delineated problems top managers face in two dimensions: problem complexity and problem structure. Treacy related the types of computer-based support tools which apply to four types of problems:

1. Relatively simple, relatively structured: data-oriented decision support systems (DSSs).
2. Relatively complex, relatively structured: model-oriented DSSs.
3. Relatively simple, relatively unstructured: information support systems.
4. Relatively complex, relatively unstructured: fuzzy modeling and expert support. (Treacy, 1986, p. 181).

Treacy's (1986) conclusions were based on the capabilities of the manager's mental models to support decision making. For strategic problems (complex, unstructured problems), Treacy suggested mental models need to become explicit. Treacy also suggested the modeling methods developed in the area of artificial intelligence, especially experts systems, could be utilized to either make explicit the manager's mental models or to develop the type of models needed to support strategic decision making.

Keen and Wagner (1979) translated Mintzberg's (1973) characterization of managerial work into a set of design criteria for supporting top managers. The design criteria centered on a flexible modeling language with managerial natural language and graphical languages (Keen & Wagner, 1979, p. 118). The system provided the manager and support staff with a means for rapid development and financial analyses of alternative strategies.

Rockart and Treacy (1982) surveyed sixteen companies in which at least one of the top managers, usually the chief executive officer, directly accessed computer-based information on a regular basis. Their work pointed out top managers access a cube of information. The information cube has three dimensions: important business variables, time (historical and future projections), and business units. Though the precise content and organization of the information cube differed from manager to manager, the dimensions of the cube remained constant. Top managers accessed the information cube 1) for status information and 2) to perform analyses of the information, in some cases actually developing computer programs for analyses. Rockart and Treacy (1982) also point out that a personal support staff was usually created to support the top manager's use of the computer-based information. Rockart and Treacy (1982) report top managers who use computer-based information systems say the advantages are that the systems help them:

- think by improving their mental models, by developing information needs, by developing the right questions to ask, by allowing them to think graphically, and by allowing them to test ideas;
- find answers by searching through the detailed information, through more effective means than support staff, and by finding variances in the detail others would not see;
- conduct independent analyses for checks and balances on staff conclusions; and
- promote analytic thinking throughout the organization.

2.5 Strategic Information

Rouse (1984) distinguishes two attributes of information--form and content. Form represents how the information is portrayed to the manager, e.g., text or graphs and verbally or written. "Of greater importance is content" (Rouse, 1984, p. 236). Content refers to what information is portrayed to the manager, e.g., information about the manager's operation.

Form issues have been studied extensively (Huber, 1983; Daft & Lengal, 1984; Rouse, 1984; and Zmud, 1979). Mintzberg's (1973) study revealed top managers overwhelmingly preferred verbal information. Mintzberg's conclusion as to why related to the desired attributes of current, trigger information. Daft and

Lengal (1984) relate verbal information as the "richest" medium--communicating more attributes of information than other mediums. Both indicate the difficulty in substituting a different "form" of communication for verbal communication to top managers.

Content issues have been studied less, and attributes of information content tend to vary from researcher to researcher depending on need. Berube (1990) presents a number of classifications and attributes of information in his work on information and data. Figure 3, *Information Characteristics from the Literature*, presents the authors and characteristics reported by Berube and adds the characteristics identified by Gorry and Scott Morton (1986) and Kurstedt (1990b) as being important to distinguish strategic work from other types of work.

2.6 Procedures for Studying Managers

This research focuses on strategic decision making which requires a need to understand the manager's thinking processes. Therefore, this literature review focuses only on these procedures and not on the procedures for studying decision making processes in organizations, e.g., the observation procedures used by Mintzberg et al. (1976) to derive their model of strategic decision making.

The procedures for studying manager's thinking processes fall into the category of methodologies called process tracing. There are two major process tracing methods:

> "... verbal protocols and information boards. Verbal protocol analysis requires the (manager) to think aloud while actually making decisions. Decision makers are asked to describe what they are thinking or doing as they go through their evaluation of information. The verbal statements can then be coded and hypotheses tested regarding a model or theory of the decision process. Information boards require participants to explicitly search for information about available alternatives and usually require a choice

PETERSON (1977)
- Relative (Comparing 2 datum)
- Relational (Cause/effect)
- Aggregated/Disaggregated (Level of Detail)
- Macro/Micro (Manager's span of control)
- Price data

DEARDEN (1965)
- Representative - financial, personnel, logistic marketing, strategic planning, personal observation

MURDICK (1980)
- Symbols
- Experience Stimuli (initiate behavior-information/don't-data)

HILL (1989)
- Accuracy
- Timeliness
- Relevant

BENDER (1983)
- Entities (All these are representing reality)
- Relationships
- Attributes (of entities and relationships)
- Types: Images, Sounds, Characters

IJIRI (1975)
- "Hard" data - Verifiable facts, measurable

JONSSON (1987)
- "Hard" data - Quantitative
- "Soft" data - Qualitative

TUSHMAN & NADLER (1978)
- Relevant
- Accurate
- Timely
- Concise

PETERSON (1977)
- Decisive
- Implementation
- Persuasive
- Damaging
- Required

MINTZBERG (1972)
- Internal Operations
- External Events
- Analyses
- Ideas & Trends
- Pressures

KURSTEDT (1990b)
- Sources
- Types
- Age
- Use
- Function
- Structural (Berube)
- Linkage to Decision Steps
- Other

GORRY & SCOTT MORTON (1986)
- Source
- Scope
- Level of Aggregation
- Time Horizon
- Currency
- Required Accuracy
- Frequency of Use

ROUSE (1984)
- Aggregated/Disaggregated
- Patterns/Elements
- Current/Projected
- Means: Explicit/Implicit

DICKSON ET AL. (1977)
- Format
  - Content
  - Form
  - Presentation
- Media
- Time
  - Availability

LEEDY (1983)
- Primary/Secondary

Figure 3. Information Characteristics from the Literature

among the available alternatives. Examination of the decision maker's depth and pattern of information search can be examined to identify alternative models or strategies used in making a decision" (Ford et al., 1989, p. 77).

Newell and Simon (1972) used a combination of these two methods in their research on human problem solving. Payne et al. (1978) and Payne (1976) have advocated the value of using a combination of these approaches to understand the detail of decision processes.

2.7 Summary

The literature indicates that decision making is just one of the activities of managers and that managers make different kinds of decisions, e.g., strategic decisions, tactical decision, operational decisions, and clerical decisions. There exist group decision processes and individual decision processes. A manager's decision making process can be represented contextually as a process with inputs and outputs. A manager is faced with information representing a problem which when perceived by the manager, i.e., input, initiates a mental decision process in the manager. The manager may use decision tools to support his or her decision processes by manipulating and providing information. The output of the manager's decision processes is one or more decisions.

Strategic problems are ill-defined problems of organized complexity. Strategic decisions are decisions about the rules by which the organization behaves. Strategic decision processes involve more judgment, evlove from simple to more sophistocated, involve mental models of reality, involve searching for operators to balance the organization with changes in the organization's environment, and are less likely to be replicated than other types of decision processes. Decision processes can be represented as information processing systems.

To determine the characteristics of the information needed for strategic decision process support requires studying managers' mental decision processes. The procedures for studying mental processes employ verbal protocols, information boards, or both.

3.0 RESEARCH CONCEPTS

Chapter 3.0, *Research Concepts*, describes the contextual models developed to meet the first research objective. The contextual models have their origins in the literature presented in Chapter 2.0, *Literature Review*, and are expanded to describe how managers' strategic decision processes relate to the characteristics of information. The models provide the fundamental perspectives necessary to develop methods for studying information characteristics for further research of decision tools to support managers' strategic decision making, because it is the decision tools' role to provide information to support managers.

Chapter 3.0, *Research Concepts*, begins with a section extending the theories of what managers do, as presented in Chapter 2.0, *Literature Review*, to describe the nature of nuclear government-oversight-agency (GOA) managerial work. Section 3.1, *The Nature of Nuclear Government Oversight Agencies*, is presented as evidence that nuclear GOA managers are experienced in dealing with strategic problems. Therefore, the population of nuclear GOA managers provides a rich environment for descriptive research using the models of strategic decision making.

There are three contextual models presented to describe strategic decision making in increasing levels of detail. Section 3.2, *Context Model for Strategic Decision Making*, expands the overview of strategic decision making shown in Chapter 1.0, *Introduction*, Figure 1, *The Context Model Overview for Strategic Decision Making*, to show the subcomponents which become important in understanding the interplay between information and the decision processes. Section 3.3, *Mental Strategies*, describes in more detail the role of general problem solving approaches as mental strategies which link strategic problems with strategic decisions. The final model is the elementary mental activities model described in Section 3.4, *Elementary Mental Activities Model*. Elementary mental activities are presented as a single set of mental activities that represent the manager's strategic decision processes. This set of mental activities is detailed enough to uncover the characteristics of information needed to support the mental activities, but not detailed enough to allow replication of the manager's strategic decision making processes. To replicate the processes requires discovery of the basic mental functions which make up the elementary mental activities. Determining mental functions, if feasible, is beyond the scope of this research.

Section 3.5, *Strategic Information*, presents the framework relating the characteristics of information from Chapter 2.0, *Literature Review*, to the contextual models. This framework of information characteristics enables experimentation to determine the information needs of nuclear GOA managers making strategic decisions.

3.1 The Nature of Nuclear Government Oversight Agencies

Nuclear government oversight agencies (nuclear GOAs) are a subset of GOAs which are in turn a subset of all government organizations. As such, nuclear GOAs inherit characteristics that are uniquely government and oversight in nature, as well as possessing a unique set of characteristics distinguishing them from other GOAs. As government organizations, nuclear GOAs take on two characteristics that are important for this research.

First, as opposed to industry where profit rules, government organizations are less driven by financial considerations than industry. This translates into a different emphasis on evaluating the success of government organizations. Kurstedt and Sink (1990) propose there are four criteria for successful management: resources (which includes cost), schedule, quality (which includes product specifications), and critics. In industry, the performance evaluation of an organization is firmly based on the quantifiable cost criterion. In government, critics is the one criterion that stands out. Critics is a more qualitative criterion.

The second characteristic important for this research is the reactive nature of government organizations. Sheridan (1988) emphasizes this point in his interview with E. L. Williamson, Chairman and CEO of the Louisiana Land Exploration Company. Williamson says past legislative and administrative actions have been largely reactions to specific crises or emergencies. Therefore, much of government action focuses on short-term issues.

Therefore, much of government managers' work is reactive and judged on the more qualitative dimension of critics.

3.1.1 Distinguishing Characteristics of GOAs

In his proposal to the U. S. Department of Energy (DOE) in 1986 titled "Research and Development of Models and Instruments to Define, Measure, and Improve Shared Information Processing within Government Oversight Agencies," Kurstedt coins the term "government oversight agencies" (GOA) (Kurstedt, 1986, p. I-1). Based on the earlier work of Mallak and Kurstedt (1985) and Kurstedt et al. (1985), Kurstedt distinguishes GOAs from other government organizations by identifying six characteristics to support that GOAs overwhelmingly manage information and not physical things. Briefly stated, the six distinguishing characteristics are:

1. GOAs' primary function is to process information.
2. GOAs are uniquely and enormously subject to scrutiny.
3. GOAs characteristically manage pursuits at the highest level of uncertainty.
4. GOA managers must and will routinely spend a great deal of time fighting information crises and developing plans.
5. GOA procurement processes for automated information processing is often not systematic, resulting in magnifying the problems it was supposed to alleviate.
6. GOAs need tools that will endure leadership turnover and technological change.

In his proposal "Research and Development of Methods and Tools for Achieving and Maintaining Consensus Processes in the Face of Change Within and Among Government Oversight Agencies," Kurstedt (1988) refines his definition of GOAs and supports the characteristics with the literature. GOAs are "those bodies at all levels of government (federal, state, and local) charged with implementing laws made by the Congress and by state legislatures" (Kurstedt, 1988, p. 4). Kurstedt highlights four distinguishing characteristics of GOAs. First he considers the characteristics of the GOAs' environment. The key distinguishing characteristics of the GOA environment are:

1. Polyonomy; GOAs have complex organizational interfaces and are "many ruled."

2. Scrutiny; GOAs are under the scrutiny of many other government and industry organizations as well as being open to the public.
3. Uncertainty; GOAs exist in a turbulent environment of change and also address our most difficult problems with no obvious solutions.

Kurstedt adds to the environmental characteristics the following characteristic,

4. Implementers and Interpreters: GOAs play a central role in the public policy process.

3.1.2 Nuclear GOAs

For this research, nuclear GOAs are defined as those GOAs with responsibility for facilities to create, process, and/or dispose of nuclear materials. Examples of nuclear GOAs at the federal level are the DOE, the United States Department of Defense (DoD), and the United States Environmental Protection Agency (EPA).

3.1.2.1 Nuclear GOAs Deal with Nuclear

When you examine the early years of nuclear GOAs, the 1940's, 1950's, and 1960's, the work of nuclear GOA managers was not typical of GOAs. Nuclear GOA managers operated behind a curtain of secrecy, removed from the scrutiny and uncertainty associated with today's GOAs. The overwhelming public concern of the threat of Soviet domination gave the nuclear GOA managers much more control over their environment, diminishing the typical characteristic of polyonomy. They typically had a free reign.

In the more recent history, the 1970's and 1980's, the cloak of secrecy has been removed and the threat of Soviet dominance diminished in the public's eye. The United States government's defense nuclear facilities now fall under the regulatory auspices of the EPA and the United States Nuclear Regulatory Commission (NRC), whereas they were "self-regulated" before. The situation nuclear GOA managers find themselves in now is one where the characteristics of polyonomy, scrutiny, and uncertainty are exacerbated.

3.1.2.2 Nuclear GOAs Manage Manufacturing Facilities

Nuclear GOAs are also distinguishable from other GOAs in they are responsible for some aspect of manufacturing facilities and therefore have an industry like operation. They must meet production deadlines with manufactured goods that meet strict, quality standards. But, they must do so without the close tie to the manufacturing personnel and facilities that industry typically has. They must do so through information, e.g., policies, plans, guidelines, and reward systems. The differences between running the manufacturing facilities from a GOA perspective versus an industry perspective are more of a matter of emphasis rather than absolute differences.

3.1.3 Managerial Work of Nuclear GOAs

3.1.3.1 Nuclear GOA Managers Are Continually Involved in Strategy Work

Mintzberg defines strategy work, in general terms, "as revolving around the interplay of three basic forces: (a) an *environment* that changes continuously but irregularly, with frequent discontinuities and wide swings in its rate of change, (b) an organizational operating system, or *bureaucracy*, that above all seeks to stabilize its actions, despite the characteristics of the environment it serves, and (c) a *leadership* whose role is to mediate between these two forces" (Mintzberg, 1978, p. 941). When you compare Mintzberg's definition of strategy work with the characteristics of nuclear GOAs, an obvious conclusion is nuclear GOA managers are continually involved in strategy work.

3.1.3.2 Nuclear GOA Managers Focus On Disturbance Handling

The reactive nature of government work and the high degree of polyonomy, scrutiny, and uncertainty combine to indicate nuclear GOA managers spend much of their time in the disturbance handling role. The emphasis of reactivity instead of proactivity in nuclear GOAs would indicate the manager's informational roles are most often driven by the manager's disturbance handling role.

Therefore this research assumes that nuclear GOA managerial work centers on the managerial decision role of disturbance handling which is a part of strategy work. Certainly the other roles are present. This is a matter of emphasis. Comparing the results of a Mintzberg-type study of nuclear GOA managers with other managers, it is assumed that nuclear GOA managers spend more time in disturbance handling (and consequently strategy work in general) than other managers.

3.2 Context Model for Strategic Decision Making

The context model in Figure 4, *The Strategic Decision Process Model*, shows the components and subcomponents of strategic decision making important in understanding the interplay between information and the manager's strategic decision processes. First the nature and relationships of the components are described in an overview of the model. Then the components are addressed in more detail where necessary. The manager's strategic decision processes component is expanded in Section 3.3, *Mental Strategies*, and Section 3.4, *Elementary Mental Activities Model.*

3.2.1 Context Model Overview

There are three distinct paths of information flow to the manager: units of information constituting the strategic problem, direct observation of the decision environment, and information supplied by the decision tools. In some cases it is difficult to separate the information a manager receives into these three paths. Consider a manager in an emergency operations center. Most of the manager's external information comes through the decision tools. The manager does not directly observe the incident and the information about the problem is communicated through the decision tools. In the case of the emergency manager, the three distinct paths are collapsed into a single path through the decision tools.

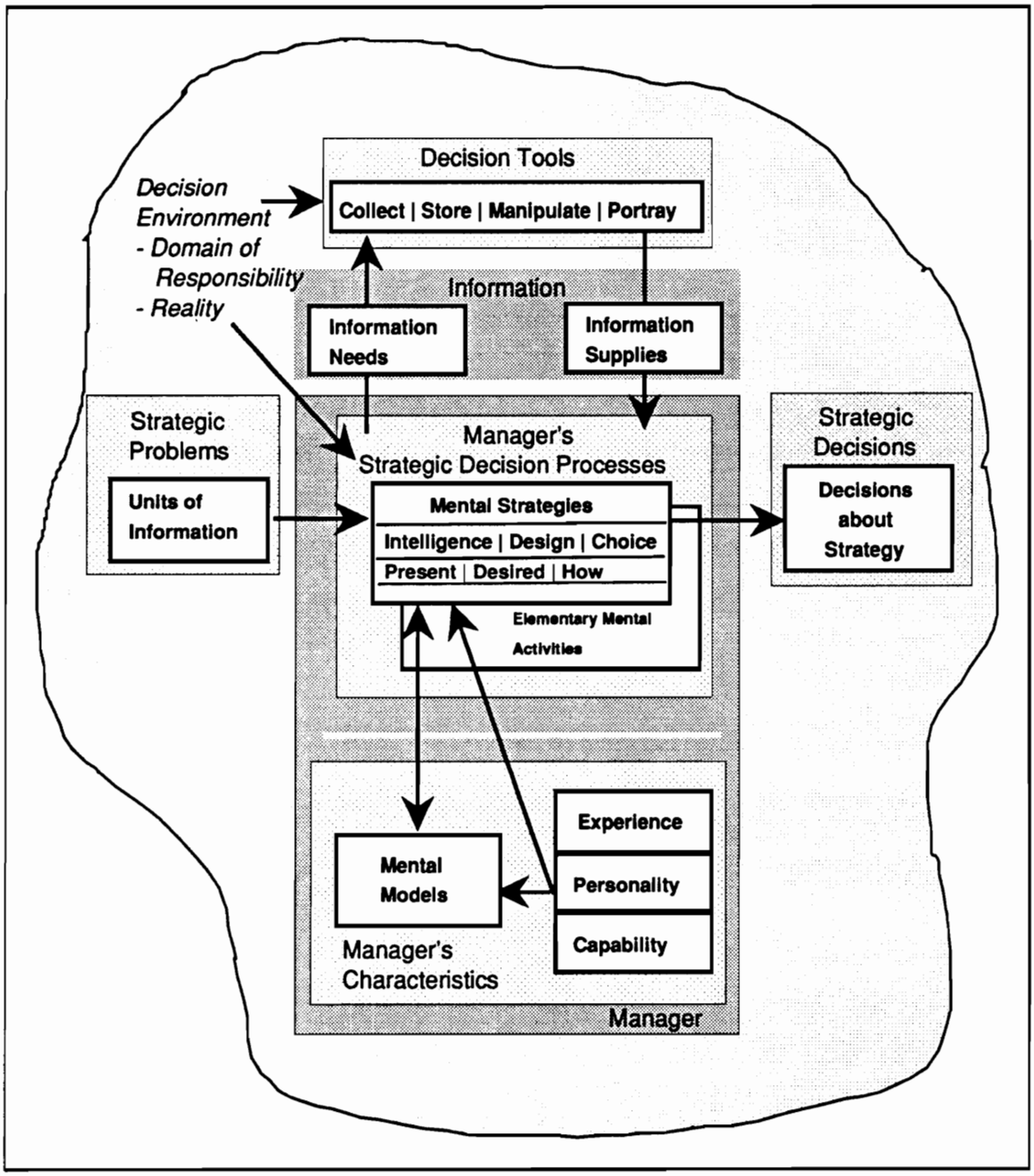


Figure 4. The Strategic Decision Process Model

The distinction in the information paths is made here to enable the researcher to manage the information flows in a research setting. The units of information representing the strategic problems is the initial information the manager receives. The information a manager requests is a need the decision tools must fulfill. The third path of external information to the manager is direct observation of the decision environment by the manager. All other information is internal to the manager.

The manager receives units of information, that represent a strategic problem for the manager. The manager applies some basic problem approaches called mental strategies to interpret the units of information to formulate a problem or a set of problems and to arrive at decisions about the organization's strategies. During the strategic decision process, the manager may need information and the decision tools may supply information to support the manager's strategic decision processes. The manager may also receive information support from direct observation of the decision environment.

The mental strategies employed depend on the manager's experience, personality, capability, and perception of the problem. Throughout the process, the manager utilizes and develops mental models. Mental models are the manager's understanding of reality and the means by which the manager predicts future reality. The manager's mental models are a function of the manager's experience, personality, and capability. The manager's perception of the problem depends on the manager's mental models.

There are two different mental strategies shown in Figure 4, *The Strategic Decision Process Model.* The first is intelligence, design, and choice, which corresponds to Simon's (1960) three phases of decision making. The second is a common problem solving approach of determine where we are now, determine where we want to be, and determine how to get there. A priori mental strategies guide the manager in thinking through the problem and are referred to as problem solving approaches. A posteriori mental strategies represent the phases (or groups of activities) the manager used in thinking through the problem and are typically referred to as problem solving phases. Mental strategies describe the manager's decision processes for the purposes of describing how the manager progresses from units of information to a decision about strategy. A more detailed concept of the manager's strategic decision processes is necessary to understand the characteristics of the information the manager needs to support decision making. This more detailed concept is presented in Section 3.4, *Elementary Mental Activities Model.*

There are at least three distinct levels representing of the manager's strategic decision processes: mental strategies, mental activities, and mental functions. The first two are shown in Figure 4, *The Strategic Decision Process Model.* Mental strategies are composed of mental activities which, in turn, are composed of mental functions. An analogy to building a house, though simplistic, is useful. Mental strategies are analogous to set the foundation, frame the walls, put on the roof, finish the outside, and finish the inside. Mental activities are analogous to hammering, sawing, and laying block. Mental functions are analogous to place hand on hammer, lift hammer, pick up nail, hold nail in place, and strike the head of the nail with the hammer. In the case of strategic decision processes, it is at the mental activities level where a meaningful perspective of information is found. Mental functions are a matter of psychological and physiological research. Therefore, this research focuses on the first two levels of representation--mental strategies and mental activities. The term elementary mental activities is used in Figure 4, *The Strategic Decision Process Model,* to propose that a single set of mental activities can be determined upon which all the manager's mental activities in strategic decision making are based. The mental activities in this set are called elementary mental activities.

3.2.2 Strategic Problems

To summarize the previous discussions of strategic problems in Section 1.1.1, *Strategic Problems*, and Section 2.2, *Decision Making Process*, strategic problems are situations which have or are perceived by the manager to have the real or potential effect of altering the global rules by which the manager's organization operates. Strategic problems are composed explicitly or implicitly of a set of available information about the situation, a question to be answered, and constraints.

Strategic problems do not typically present themselves to the manager in a well-defined manner. The manager finds them by interpreting and relating units of information (Mintzberg, 1973; Pounds, 1969). The units of information are about the manager's operation and the manager's environment and typically represent a change in direction or an event that might result in a change in direction (Mintzberg, 1978). Mintzberg (1973) calls this information current, trigger information in that it triggers a response on the manager's part to consider the strategy of the organization in light of the current situation represented by the meaning of the units of information as interpreted by the manager.

3.2.3 Strategic Decisions, Information, and Decision Tools

The result of the manager's mental activity to formulate a strategic problem is a decision about the organization's strategy (Gorry, 1971; Mintzberg, 1978). The organization's strategy is the set of rules by which all other decisions are made. The policies, culture, mission statement, and other corporate documents and understandings represent the organization's strategy.

Information links the manager with the decision tools. The manager requests information from and may provide information to the decision tools. For example, the manager may request a forecast of material supply from his support staff. In the process of this request, the manager may provide some assumptions to be used in the forecasting procedure. The manager also receives information from the decision tools.

The decision tools support the manager by collecting, storing, and manipulating information (Kurstedt et al., 1989). Decision tools include people, like analysts, information coordinators, and experts, as well as things like computers, calculators, paper and pencil, and procedures.

3.2.4 Manager's Characteristics

The manager possesses and develops mental models of the organization, its environment, and their interactions (Piaget, 1974; Ramaprasad & Mitroff, 1984, Pounds, 1969). The manager uses mental models:

1. to filter units of information (Treacy, 1986, p. 173),
2. to interpret and relate units of information to formulate strategic problems (Ramaprasad & Mitroff, 1984, p. 597),
3. to generate alternative strategies for dealing with strategic problems (Pounds, 1969, p. 4),
4. to evaluate alternative strategies (Mintzberg et al., 1976, p. 256), and
5. to choose an alternative for implementation (Mintzberg et al., 1976, p. 258).

There are four characteristics of the manager: experience, personality, capabilities, and mental models, that are highlighted for strategic decision making in Figure 4, *The Strategic Decision Process Model.* These characteristics affect the manager's strategic decision processes.

The manager's personality will not only affect what mental strategies are used to find and address the strategic problem (Kurstedt et al, 1989), but will affect whether or not the manager sees the units of information as a strategic problem (Ramaprasad & Mitroff, 1984). Ramaprasad and Mitroff (1984) propose four types of personalities and suggest those people who are synthesizers make the best strategists because they like strategy work.

The manager's experience is reflected in the number, type, and sophistication of the mental models and mental strategies the manager has available. Ramaprasad and Mitroff (1984) suggest the manager begins with a previously developed mental model. For example, if the manager's experience includes operating a nuclear reactor, then the manager is likely to have one or more sophisticated mental models of how nuclear reactors work. If that manager learns a coolant pump in a nuclear reactor has failed, the manager will be able to draw implications from the information and make decisions more quickly than a manager without an adequate mental model. The inexperienced manager will need to ask questions to develop an adequate mental model before he can draw implications and make decisions.

The manager's capability includes the manager's innate and acquired capabilities like intelligence, cognitive ability, and communication skills. The manager's capability affects the manager's ability to develop, maintain, and manipulate mental models and mental strategies.

3.2.5 Manager's Strategic Decision Processes

The manager uses mental strategies to formulate strategic problems (Kurstedt et al., 1989; Mintzberg, 1973; Pounds, 1969). Whereas the precise formulation varies from strategic problem to strategic problem, the mental strategies remain relatively constant (Simon, 1960). They are higher-order programs of mental work (Mintzberg, 1973). Figure 4, *The Strategic Decision Process Model,* shows two, possible mental strategies.

The first is Simon's (1960) phases of decision making: intelligence, design, and choice. The second is a common place heuristic stating first you need to determine where we are (present), then to determine where we want to be (desired), and finally to determine how to get there (how).

Based on the units of information, the mental strategies employed, and the manager's mental models, the manager engages in some form of strategic decision processes resulting in strategic decisions. The mental efforts the manager exerts while engaged in the strategic decision processes can be defined as the manager's mental activities--the first-order program of strategic decision making.

The first-order program is represented by a set of primitive functions (Newell & Simon, 1972; Greenewell, 1988). Primitive functions serve to replicate the manager's mental activities. It is not clear that primitive functions can be defined to represent strategic decision making processes (Simon, 1987).

Elementary mental activities are proposed as a higher-order program than primitive functions and as a lower-order program than mental strategies. The purpose of creating the elementary mental activities level of program is to arrive at a program level that is both tractable and detailed enough to allow meaningful representation of the characteristics of information.

3.2.6 Importance of the Model

Mintzberg (1973) concluded that to support managers it is necessary to first study what managers do. For strategic decision making, this model provides the components and sub-components that are important to study. For example, to study the manager's strategic decision making, so that it is possible to design and build decision tools, means studying the manager's mental strategies and mental models. By understanding the manager's mental strategies and mental models and how they vary from strategic problem to strategic problem, the researcher can begin to predict the nature of the information the decision tools must provide the manager for support.

3.3 Mental Strategies

Figure 5, *Mental Strategies*, incorporates a problem solving approach as a mental strategy into the context model of strategic decision making. The problem solving approach shown in Figure 5, *Mental Strategies*, is a form of a common heuristic with the elements (1) determine where we are, (2) determine where we want to be, and (3) determine how to get there. Another example that can be used in the same manner is Simon's (1960) phases of decision making: intelligence, design, and choice. Each element of the approach represents a group of mental activities. Each element of the approach is general enough that there exist mental strategies for each element. For instance, managers might employ a variety of mental strategies for determining where we are.

Therefore, general problem solving approaches are considered as general mental strategies. Each element of the general mental strategy is considered to be composed of a group of mental activities and a class of lower-order mental strategies.

Using Simon's (1960) phases of decision making as an example of a mental strategy, if the purpose of a set of mental activities is to choose and create entities and relationships to describe either historical or predict future reality, the manager is executing an intelligence strategy. If the purpose is to choose or create different sets of operators and desired outcomes, then the manager is executing a design strategy. If the purpose of the activity is to choose one set of operators to match one set of desired outcomes, then the manager is executing a choice strategy.

Therefore, by examining the nature of the information the manager uses, the mental strategies can be determined. As many authors point out (Mintzberg, 1975; Simon, 1960; Pounds, 1969), this is not easily done. However, the concept of elementary mental activities and their relationship to strategies through the nature of information sets the foundation for investigation of mental strategies.

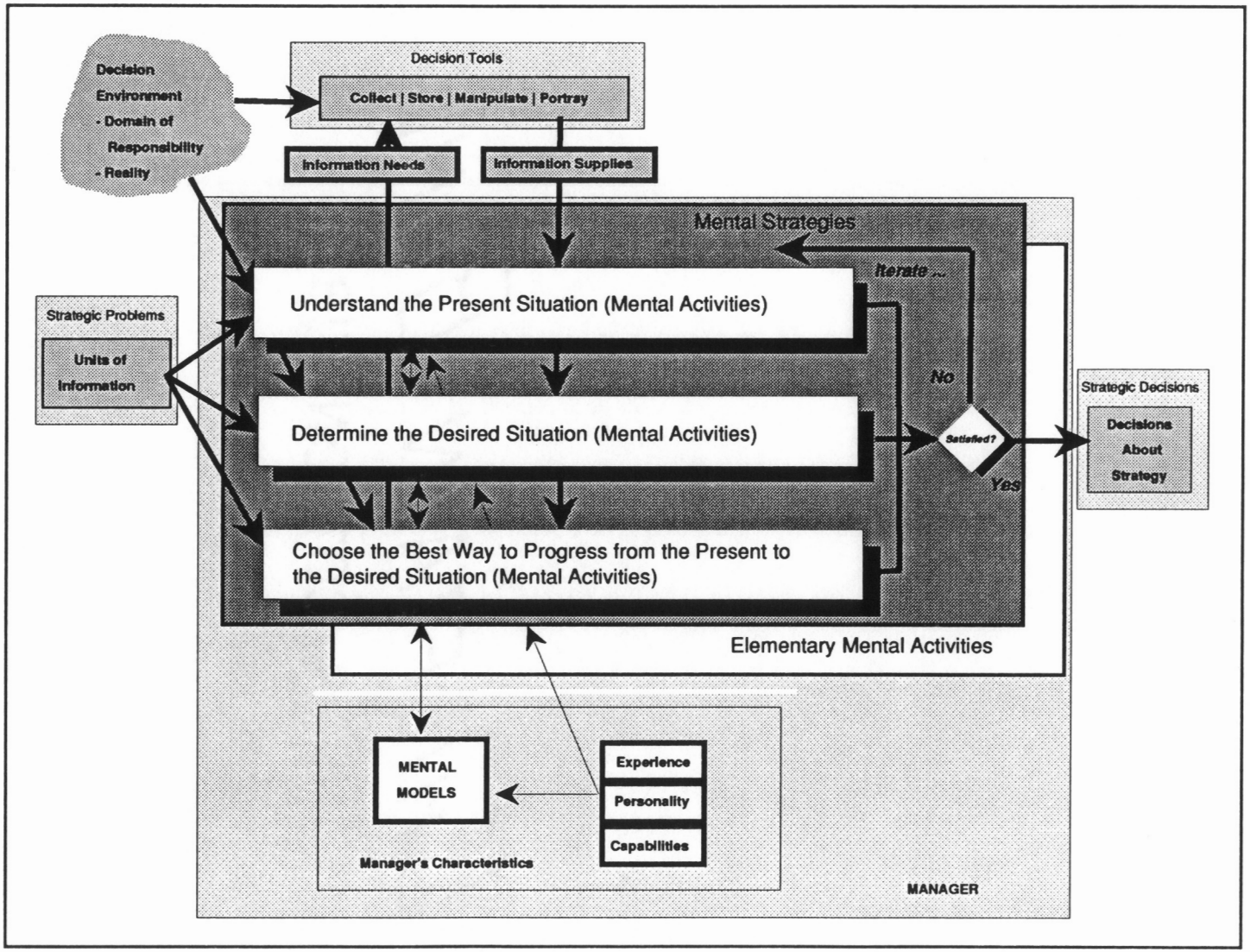


Figure 5. Mental Strategies

3.4 Elementary Mental Activities Model

Figure 6, *The Elementary Mental Activities of Strategic Decision Making*, shows the model of elementary mental activities and their relationship to information. This mental activities model is an extension of Pounds' (1969) model principally using Ramaprasad and Mitroff's (1984) model. The term elementary is used to distinguish these mental activities as building blocks upon which strategic problem formulation is based. Newell and Simon (1972) in their work on replicating human problem solving and others in the field of expert systems (Greenwell, 1988) represent basic mental activity using a set of primitive functions. Primitive functions are more detailed than the elementary mental activities proposed here. Primitive functions are intended to replicate mental activity. Elementary mental activities are intended to represent the major mental activities in relation to information. As such, elementary mental activities represent groups of primitive functions.

3.4.1 Origins of the Elementary Mental Activities Model

Ramaprasad and Mitroff's (1984) model of strategic problem formulation relates to the Pounds (1969) model. The Ramaprasad and Mitroff model has the advantage of appearing more dynamic than the once-through model of Pounds. Extending the concept of forming mental models (or logico-mathematical-structures) to more than just explaining reality makes it possible to apply the iterative development of mental models to the strategic problem formulation process. This was accomplished by allowing the manager to compare the deductions of the mental model with desired outcomes instead of just reality. The selection and modification of the mental model through reflexive abstraction then equates to the search for alternative operators in Pounds' model.

The result in relating the two views of strategic problem formulation is that it is possible to describe the steps of strategic problem formulation as iterations of a simple set of elementary mental activities related to the processing of basic types of information. The mental activities chosen are based primarily on Pounds' (1969) work.

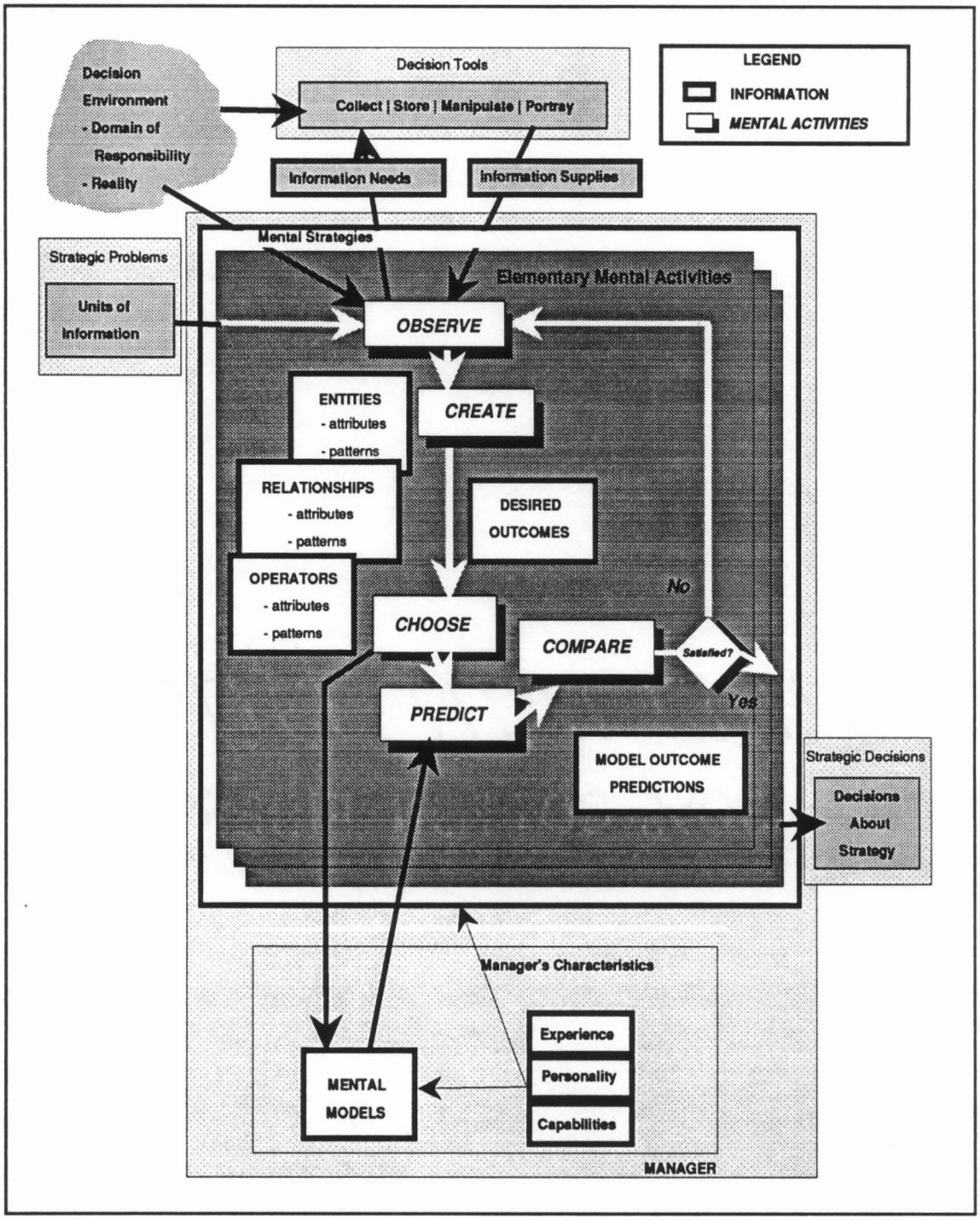


Figure 6. The Elementary Mental Activities of Strategic Decision Making

3.4.2 Description of the Elementary Mental Activities Model[1]

3.4.2.1 Information

There are five types of information shown in Figure 6, *The Elementary Mental Activities of Strategic Decision Making*, that the manager uses in the manager's strategic decision processes. They are *entities*, *relationships*, *operators*, *desired outcomes*, and *model outcome predictions*. *Entities*, *relationships*, and *operators* along with their attributes are proposed as the three basic types of information. These form the manager's perception of external information. The manager chooses certain values of *entities*, *relationships*, and *operators* as desired outcomes. The assumption is that even though the model outcome predictions are generated within the manager's thinking processes, they can also be represented by the three basic types of information.

An *entity* is "something that has separate and distinct existence and objective or conceptual reality" (Webster's, 1988). *Relationships* are "logical or causal connections" (Webster's, 1988) between *entities*. Attributes of *entities* and of *relationships* are inherent characteristics. Viewing reality as *entities*, *relationships*, and their attributes has been the focus of systems engineering (Blanchard & Fabrycky, 1981) and systems analysis and design techniques (Chen, 1980).

Applying this perspective to the information used by managers in strategic decision processes provides a meaningful relationship between the information and the processes. The process of the manager building *mental models* is analogous to the processes systems engineers use to build entity-relationship models of reality. Therefore, the manager simply chooses sets of *entities*, *relationships*, and their attributes, which become the manager's *mental model* analogous to the systems engineer's explicit model. The manager's *mental model* is then ready for manipulation to *predict outcomes*, just as the systems engineer's explicit model is used.

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1. The mental activities and information of the elementary mental activities model presented in this section are in italics to facilitate reference to the model.

For the purposes of viewing the information used in strategic decision processes, it is helpful to separate relationships which affect or are designed to affect normality with other types of relationships. The term *operator* was first used in describing aspects of strategic decision processes by Pounds (1969). Pounds use the term *operator* to describe elements of managerial activity. Pounds' definition was "An operator transforms a set of input variables into a set of output variables according to some predetermined plan" (Pounds, 1969, p. 5). From the systems engineering perspective, an *operator* is a relationship whereby an entity exerts force on a system to alter the existing *entities*, *relationships*, and/or their attributes.

Both *desired outcomes* and *model outcome predictions* are selected values of the three basic types of information. *Desired outcomes* are the values of *entities*, *relationships*, *operators*, and their attributes the manager considers desireable. *Model outcome predictions* are values of *entities*, *relationships*, *operators*, and their attributes the manager expects to occur in reality, whether the reality is historical reality or some future reality.

The above definitions for the three basic types of information are the initial definitions for experimentation. They become the general rules for coding data from the experiment. As the experimental data are coded, operational definitions and rules will be developed. The process of defining, establishing rules, coding, and evaluating the meaningfulness of the resulting data is an iterative process described in Chapter 4.0, *Experiment*.

3.4.2.2 Observe and Create

The manager *observes* reality, forming information in his mind to represent reality (Pounds, 1969). Ramaprasad and Mitroff (1984) use the term simple abstraction to describe the mental activity of *observing*. The manager either directly *observes* reality, in which case, the information in the manager's head is primary information (Leedy, 1983) or he *observes* information about reality, in which case, the information in the manager's head is secondary information.

The information about reality can come from any source, e.g., newspapers, informal conversations, and formal information systems (Pounds, 1969). Information about reality can be represented comprehensively by saying the information either represents *entities*, attributes of entities, *relationships*, or attributes of relationships (Bender, 1983). Rouse (1984) suggests patterns of *entities* and *relationships* of reality are important information when the manager is dealing with strategic problems.

The manager may also *create* information about reality to fill gaps in the available information. *Creating* information about reality occurs in the process of developing a mental model to explain reality (Piaget, 1974). For instance, the manager might generate alternative *relationships* between two *entities* thinking through each to arrive at an adequate explanation for why the information the manager *observed* about reality is as it is (Ramaprasad & Mitroff, 1984). The manager initially *creates entities* and *relationships* by using components of a *mental model* previously developed for what the manager conceives as a similar problem (Ramaprasad & Mitroff, 1984). If the manager is unable to *create* a *relationship* or set of *relationships* to explain reality, or if the *relationships* that explain reality are not acceptable to the manager, the manager may reject the information (Treacy, 1986).

The manager also *observes* or *creates desired outcomes* (Kurstedt, 1990a) which are particular *entities*, *relationships*, *operators*, and their attributes. When the manager attempts to explain the reality he or she wants, the manager's understanding of reality becomes the *desired outcome*. When the manager attempts to devise a strategy for meeting the organization's financial objectives, the *desired outcomes* are the organization's financial objectives. In the case where the manager's perception of reality no longer supports the organization's objectives, the manager will *create* alternative objectives which then become the *desired outcomes*.

The manager *creates operators* in the course of designing alternative strategies for formulating and for potentially solving the problem (Pounds, 1969). The rules the manager considers as the components of a potential solution to the perceived problem are *operators*. Groups of *operators* form to make problem solution strategies. Examples of these *operators* might be:

- Limit reactor power to 50%,
- Design a public relations campaign to turn around public opinion,
- Change the organization's culture to become more aggressive, and

- Build a new production reactor.

3.4.2.3 Choose

The manager *chooses entities*, *relationships*, *operators*, and *desired outcomes*. The chosen *entities*, *relationships*, and *operators* become the manager's *mental model* while the *desired outcomes* become the target for comparison. In Ramaprasad and Mitroff's (1984) model, choosing a logico-mathematical structure (LMS) is equivalent to choosing a mental model. Developing an LMS through reflexive abstraction (Piaget, 1974) is accomplished in the proposed model through the combination of *creating* and *choosing*. Pounds' (1969) verbs choose and select are represented in this single mental activity called *choose*.

The elementary mental activities model proposed here is not concerned with how the choice is made, but with the nature of the information used to make the choice. There are a number of theories as to how managers choose between alternatives. Mintzberg et al. (1976), identify three separate routines for evaluating and choosing alternatives: judgment, analysis, and bargaining. Simon (1960) indicates strategic decisions involve more judgment in making choices than other types of decisions. Investigating how manager's choose is beyond the scope of this research.

3.4.2.4 Predict and Compare

The manager uses the *mental models* to *predict outcomes* and *compares* the *predicted outcomes* with the chosen *desired outcomes*. For example, if a person sees smoke rising above the trees, but does not see the source of the smoke, the person might have several plausible *mental models* to explain the cause of the smoke. Suppose one *mental model* is "a factory produces smoke." The person using this *mental model* of cause and effect would *predict* the existence of a factory in the vicinity of the smoke. The term *predict* refers to using a *mental model* to produce information. The use of the term in this manner is not limited, as in the above example, to predicting future events or states. Ramaprasad and Mitroff (1984) refer to these activities as application--the process of deduction and testing the deductions--instead of *predicting*. The testing verb in their terminology is simply *comparing* to determine the differences between *desired outcomes* and the *model outcome predictions* (Pounds, 1969).

The objective of *compare* is a satisfycing criterion (Simon, 1960). In the situation where the manager attempts to understand reality, if the manager believes the *model outcome predictions* satisfactorily match the manager's perceptions of reality, then the manager's *mental model* becomes reality for the manager. This is the process of attribution referred to by Ramaprasad and Mitroff (1984).

Likewise, in the situation where the manager searches for alternative *operators*, when the manager is satisfied the *model outcome predictions* match the *desired outcomes*, the *mental model* with the chosen *operators* represents both the manager's perception of the problem and the manager's proposed solution of the problem.

3.4.3 Importance of the Elementary Mental Activities Concept

There are three characteristics of the proposed elementary mental activities concept of major importance to the study of strategic decision making and the role of decision tools: the nature of information, the nature of elementary mental activities, and the iterative nature of the concept. From each of these, implications can be drawn about the general nature of decision tools needed to support the manager.

The importance of the proposed elementary mental activities model is its utility to understand the decision tools needed to support strategic decision making. The arguments in the following sections demonstrate the model's utility by presenting examples of implications of the model in specifying the characteristics of decision tools. To determine specific statements of the characteristics of decision tools requires operationally defining the model for a manager (or group of managers), problem(s), and domain of responsibility. These more-specific implications are included in Chapter 6.0, *Analysis and Implications*.

3.4.3.1 Information

The entity-relationship perspective of the information in the elementary mental activities model has general implications for the design of decision tools. A number of techniques and approaches to data base design use the entity-relationship perspective (Chen, 1977). Studies demonstrate effective means of portraying entity-

relationship information. The basic implication of this perspective of information in the elementary mental activities model is that the body of knowledge and developed techniques surrounding the entity-relationship perspective can be adopted in the design of decision tools to support strategic decision processes.

The elementary mental activities model indicates the information about the decision environment should be portrayed to the manager in packages of entities, relationships, operators, and their attributes. This implies the manner in which the decision tools should portray information for efficient communication. Entities and relationships can be portrayed in system diagrams (Blanchard & Fabrycky, 1981). Resource flow diagrams like material or cash flows are also useful presentations of entities and relationships (Rouse, 1984). For patterns, Rouse (1984) suggests graphical representations such as pie-charts and circular profiles.

The elementary mental activities model also indicates the information about reality, and the operators the manager creates to potentially solve the problem are used by the manager to relate to or to refine the manager's mental models. Therefore, this information should be presented in a form that's easily assimilated by the manager. Treacy (1986) provides the following examples of the forms of operators managers use:

- "Our price should be about two times direct costs.
- Our price should be just below our dominant competitor's price.
- If our competitor's prices go too high, we should price for increased market share" (Treacy, 1986, pp. 186-187).

The term Treacy uses to describe these operators is fuzzy. Therefore in general, the decision tools should be capable of collecting, storing, manipulating, and portraying fuzzy relationships.

3.4.3.2 Elementary Mental Activities

The mental activities in the elementary mental activities model have implications for the decision tools. The elementary mental activities model indicates not only that the managers uses entities, relationships, and operators but that the manager observes them, creates them, chooses them, uses them to make predictions, and compares them. Therefore, all the mental activities can be supported by inventing ways to store, maintain, update, and portray entities, relationships, operators, and desired outcomes that allow the manager to easily observe, create new ones, group them into the manager's own logical groups, and choose them to work with.

The decision tools can support the manager's mental activity of creating information by developing groups of entities and relationships that represent logical groups of entities in the manager's organization and environment. In essence, this would provide the manager with the best available models to assimilate as mental models (Mintzberg, 1973).

Developing groups of operators which could possibly affect the organization and the environment could also support the mental activity of creating information. For instance, sets of operators could be developed that logically represent all the possible combinations of how to run the manager's manufacturing complex. The manager might create yet more-logical groups of operators, but having the groups already suggested would represent a significant amount of thinking the manager would not have to do. Simply providing a vehicle to store, group, and recall operators the manager creates would support the manager by reducing the likelihood of recreating an operator.

If we can make the manager's choice of information explicit, then the decision tools might further support the manager by assessing the choice of information. The manager's support people (or mechanisms) could begin to look for logical gaps and overlaps in the manager's choice of information and offer alternative choices (Mason & Mitroff, 1981). It might also be possible for the support people (or mechanisms) to use the choice of information to form explicit models and make predictions to support the manager's own predictions (Treacy, 1986; Gorry, 1971).

3.4.3.3 The Iterative Nature of the Concept

Because of the iterative nature of the elementary mental activities model, the entire strategic decision making process is composed of five mental activities (observe, create, choose, predict, and compare) and three basic, types of information (entities, relationships, and operators). The decision tools have a relatively small number of managerial activities to support and can do so by providing a relatively small number of basic types of information. This is not to imply the matter of support is trivial. However, the variances across managers, problems, and domains of responsibility should be limited to the more detailed characteristics of the information. This indicates the possibility of developing a set of capabilities of decision tools, e.g., a computer system shell in computer terminology, which could be useful for a wide range of managers, problems, and domains of responsibility.

3.5 Strategic Information

The elementary mental activities model (Figure 6, *The Elementary Mental Activities of Strategic Decision Making*) says managers observe and create entities, relationships, operators, and their attributes, all of which are information. If the manager observes information, the information is considered external information. The information a manager creates is considered internal information. External information is independent of the manager. Internal information is manager dependent.

The manager's external information reaches the manager in one of three paths according to the context model shown in Figure 4, *The Strategic Decision Process Model*: direct observation, part of the strategic problems, and through the decision tools. However, these paths result in two types of information: primary and secondary. External information can reach the manager by direct observation of the decision environment (primary information) or by observing others' observations of the decision environment (secondary information). No matter how the information reaches the manager, all information describes some aspect of the decision environment.

If the external information is secondary information, it is considered for the purposes of the information characteristics framework to come from the decision tools. Even if the information is part of the strategic problems, it can be considered to come from the decision tools. (See the discussion of emergency management in Section 3.2.1, *Context Model Overview*.) From reviewing the characteristics of information from the literature presented in Section 2.5, *Strategic Information*, Table 2, *The Framework of Information Characteristics: Manager Independent*, and Table 3, *The Framework of Information Characteristics: Manager Dependent*, the characteristics of information can be grouped into characteristics about the generation of information and into characteristics about the communication of information.

The manager's internal information can be categorized by how the manager uses the information and by what the information represents in the decision environment. The categorization according to manager's use depends upon the model used to represent the manager's strategic decision processes.

Table 2. The Framework of Information Characteristics: Manager Independent

INFORMATION CHARACTERISTIC	DESCRIPTION	TYPICAL SCALE
MANAGER INDEPENDENT: DECISION ENVIRONMENT		
DOMAIN OF RESPONSIBILITY		
Internal/External	Is the referent in reality within or outside the manager's domain of responsibility?	Internal | External
Level of Detail	Is this macro information or micro information for the manager's domain? (using the qualitative physics grain size as a scale.)	Level 1 | Level 2 | Level 3 |...
REALITY		
System Element	What role does the referent play in the system of reality?	Entity | Relationship | Attribute
Time Horizon	Does the information describe history or the future?	Historical | Future
Time Context	Does the information represent the behavior of a system element over time?	Pattern | Element
Tangibility	Is the referent tangible or intangible in reality?	Tangible | Intangible
Reality Type	What is the form of the referent in reality?	Image | Sound | Character
Frequency of Change	How often does the referent in reality change?	(various time scales)
MANAGER INDEPENDENT: DECISION TOOLS		
GENERATION		
Generation Type	Differs from Reality Type in this is the type of information generated to represent the referent (e.g., music to represent feelings)	Image | Sound | Character
Generation Source	Who or what generated the information?	(nominal)
Generation Source Reliability	How reliable is the source that generated the information?	Reliable | Not Reliable
Generation Source Location	Physical and organizational location	(nominal)
Generation Time	The time the referent was measured or observed	(day, month, year, hour, minutes, seconds)
Generation Age	The time elapsed between when the information was generated and when it was communicated.	(various time scales)
Generation Access	Who has access to this information?	(nominal)
Generation Availability	When can a person with proper access obtain this information?	(various time scales)
Generation Method	What method was used to generate the information?	(nominal)
Generation Method Precision	How accurate is the method for measuring the data	Ball Park | Middle of the Road | On the money
Generation Method Data Type	How hard or soft is the data about the referent?	Qualitative | Quantitative
Generation Method Measurability	Was the data measured?	Fact | Opinion
Level of Aggregation	Is the information a result of direct measurement or an aggregate of direct measurements?	Aggregate | Disaggregate
COMMUNICATION		
Communication Source	Who or what communicated the information?	(nominal)
Communication Media	What media was used to communicate the information?	Image | Sound | Character
Communication Time	When was the information communicated?	(day, month, year, hour, minutes, seconds)
Communication Frequency	How often is the information communicated to the manager?	(various time scales)
Communication Context Form	In what form was the information communicated? (e.g., briefing, report, meeting)	(nominal)
Communication Context Noise	How much other information was communicated with this information?	(ratio)

Table 3. The Framework of Information Characteristics: Manager Dependent

INFORMATION CHARACTERISTIC	DESCRIPTION	TYPICAL SCALE
MANAGER DEPENDENT		
Perception Mode	Does this information result from direct observation or secondary observation?	Primary | Secondary
Relevancy	Is this information relevant to the manager?	Relevant | Not Relevant
Required	Was this information required by the manager?	Required | Not Required
Timeliness	Did this information reach the manager when the manager needed it?	Timely | Untimely
Importance	Did this information have an impact on the manager's actions	Important | Not Important
Impact	What impact did it have on the manager? (e.g., pressures, damaging, persuasive, implementation, decisive)	(nominal)
Frequency of Use	How often does the manager use this information?	(various time scales)
Use	How did the manager use the information? (Depends on the application and theoretical concept, e.g., Entity |Relationship | Operator | Attribute, or Intelligence | Design | Choice)	(nominal)
Fit	How well does the information fit the manager's perception of reality?	Fits | Doesn't Fit

The framework of characteristics presented in Table 2, *The Framework of Information Characteristics: Manager Independent*, and Table 3, *The Framework of Information Characteristics: Manager Dependent*, groups characteristics according to the broad categories of (1) manager independent, (a) decision environment and (b) decision tools and (2) manager dependent. The decision environment characteristics of information reflect the nature of the referent (the thing the information refers to or is about) in reality and the relationship of the referent with the manager's domain of responsibility. The decision tools characteristics of information apply to any secondary information communicated to the manager. The decision tools characteristics reflect the nature of the generation and the communication of the information. The final group of characteristics, manager dependent, reflect the role the information plays in relation to the manager's mental activities. Table 2, *The Framework of Information Characteristics: Manager Independent*, and Table 3, *The Framework of Information Characteristics: Manager Dependent*, present framework with the categorization derived from the elementary mental activities model along with the characteristics from the literature within the framework. The characteristics have been refined and expanded to complete the framework. The description of the characteristic is accomplished by posing a question about the information. The answer to the question would indicate the value of the characteristic on the scale used to measure the characteristic.

The development of the framework of information characteristics enables the design of methods to measure and characterize the information managers use in strategic decision making.

4.0 EXPERIMENT

The problem this research addresses is that nuclear GOA managers need new means of decision support for strategic decision making. The elementary mental activities model developed in Section 3.2, *Context Model for Strategic Decision Making*, provides a theoretical basis for defining the information that the decision support tools must provide nuclear GOA managers. The Elementary Mental Activities Model proposes the information needed is information that describes reality in the form of entities, relationships, operators, and their attributes. Reality is described through decision tools, direct observation of reality, and units of information. However, the characteristics of this information are not known. It is the objective of the experiment to collect the data and perform the analyses necessary to demonstrate that the characteristics of the information needed by nuclear GOA managers formulating strategic decisions can be captured using a methodology based on the Elementary Activities Model. Once the characteristics of the information are known, the task of converting information needs into decision tools is assumed one of standard systems design using methods well documented in the literature on systems design, e.g., Murdick (1980) and Martin (1977).

A direct research effort (Mintzberg, 1983) is required to describe the characteristics of the information needs of nuclear GOA managers. Direct research is exploratory, descriptive, and inductive, involving two essential steps: discovery to determine patterns and generalization to create theory (Mintzberg, 1983). The discovery step of this research is described in this chapter. The generalization step will be presented in Chapter 6.0, *Analysis and Implications.*

The second objective of the research is to study the characteristics of the information needed by nuclear GOA managers when formulating strategic decisions. Achieving this objective requires collecting data characterizing the information needs using the framework developed in Chapter 3.0, *Research Concepts*, and examining these characteristics for each manager and across all managers to discover meaningful patterns in the attributes of information needs, i.e., "looking for order" (Mintzberg, 1983, p. 108).

The remaining sections of this chapter present the methods employed to collect, characterize, and examine the data.

4.1 Overview

Though the experiment does not closely parallel any other research experiment found in the literature, the overall approach closely parallels the direct research approach Henry Mintzberg (1973) used to study five chief executive officers to derive his theory of the nature of managerial work. The basic difference in Mintzberg's work and this research is that Mintzberg studied the broad, visible activities of managers. This research studies the more narrow, mental activities of managers' thinking and the information needed to support decision making. By studying the more narrow, mental activities of the manager's thinking, this research addresses a criticism of Mintzberg's (1973) work. Carroll and Gillen (1987) suggest that managerial work is mental and not directly observable. Therefore, Carroll and Gillen are critical of Mintzberg's findings because Mintzberg studied the physical, directly observable activities of managers. There should be value in studying both mental activities and physical activities as managerial work.

However, this difference in study objectives results in the application of different, basic, data collection methodologies. At the heart of Mintzberg's study was the structured observation methodology to collect data about the visible activities of the subjects. At the heart of this research is the verbal protocol methodology to elicit data from the subjects about the information they need to make strategic decisions.

Verbal protocol methodologies dictate the design of artificial stimuli and of an artificial environment for eliciting the data from the subject, i.e., the design of an experiment. This differs from structured observation methodology that Mintzberg (1973) used which allows study of the managers in their natural environment. Therefore, whereas Mintzberg's approach utilized a preliminary study and a field study, this research utilized a pilot study and a final study with an experiment conducted in a laboratory environment.

The major steps were:

- Pilot Study: The experiment procedure, coding method, and data manipulation for the final study were

tested and refined using two representative managers.

- Final Study:
  - Selected five appropriate nuclear GOA managers.
  - For each subject:
    - Collected demographic data
    - Conducted the experiment with five strategic exercises
    - For each strategic exercise:
      - Presented the strategic scenario, question, and instructions to the subject asking him or her to think aloud
      - Recorded the verbal protocol
      - Conducted the structured interview
- Coded the Verbal Protocol Data: Coded the verbal protocol data for all subjects and strategic exercises determining the information needs in terms of the manager's use of entities, relationships, operators, and attributes of each.
- Characterized and Validated the Coded Data: The information from the structured interview was used to validate the coded data from the verbal protocol. Based on the extensive domain knowledge of the researcher and the information from the structured interview, information characteristics were assigned to the coded, verbal protocol data.
- Data Manipulation: The characterized data were examined and analyzed to find patterns using the constant comparative method of analysis (Glaser & Strauss, 1967), as modified by Kurstedt (1986). The steps in the modified constant comparative method are:
  - List everything that applies,
  - Identify categories and define their properties,
  - Compare items within categories,
  - Integrate categories and their properties,
  - Test the categories by fitting new items,
  - Delimit the theory by combining categories, and
  - Iterate often.

4.2 Research Model

The research model shown in Figure 7, *The Research Model*, is based on the context model of strategic decision making developed in Chapter 3.0, *Research Concepts*, and shown in Figure 4, *The Strategic Decision Process Model*. Figure 7, *The Research Model*, shows the independent and dependent variables considered important in this research (denoted in white rectangles), the direction (order) of dependence (shown by the arrows linking the rectangles), and the treatment of the variables (shaded and labeled rectangles). The experiment treats the manager's strategic decision processes which includes mental strategies and the elementary mental activities as a "black box" process. The manager's characteristic, mental models was not be considered. The instruments for measuring the output of the process were concurrent verbalizations and structured interviews. These instruments resulted in raw research data in the form of verbal protocols and structured interview responses which were then manipulated to provide the data describing the process in terms of information needs and the output in terms of the strategic decisions.

Each subject was presented five different strategic exercises. The experimental environment was held constant across all subjects and strategic problems by utilizing one laboratory domain of responsibility and one initial domain status for all subjects and strategic exercises. The subject's experience was measured, and then assumed constant for each subject dealing with the range of strategic problems.

As the subject worked with the strategic scenario to attempt to arrive at a final decision, the subject was asked to think aloud. The subject's verbalizations were recorded using a magnetic tape recorder. The subject's verbalizations in a time-sequenced order are the verbal protocol. The verbal protocol reflects (1) the subject's strategic decision processes with the influence of the subject's mental strategies and mental models and (2) the resulting decisions.

When the subject had made a final strategic decision or progressed as far as he/she could, the researcher conducted a structured interview. The structured interview was designed to collect more specific characteristics of key information the subject recalled needing and to collect characteristics about the strategic

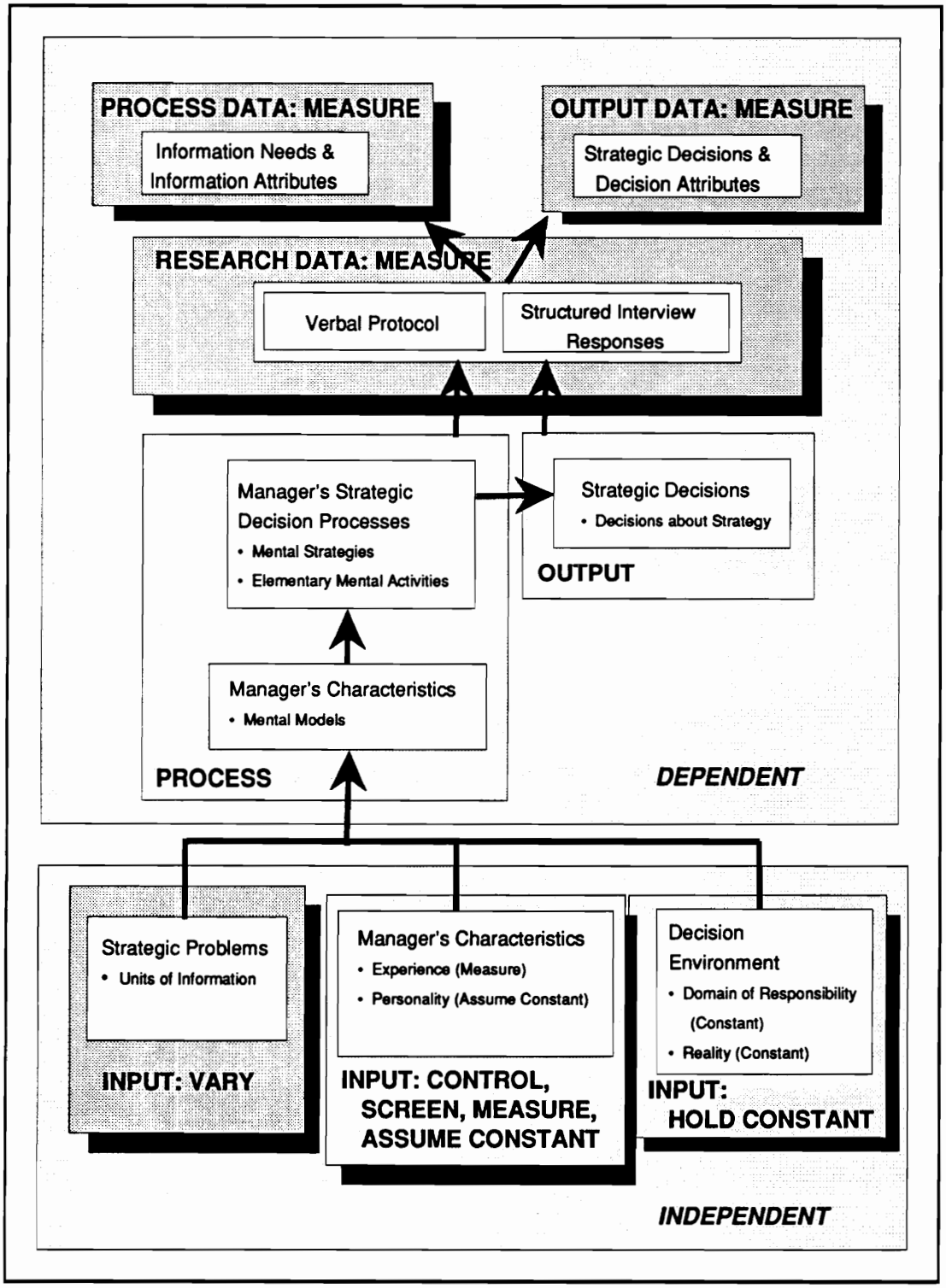


Figure 7. The Research Model

decision the subject made. A structured interview was conducted immediately after each strategic exercise. Therefore, for each subject in the experiment, the five sets of structured interview responses correspond to the five verbal protocols.

Coding the verbal protocol data and using the data from the structured interview resulted in measuring the information needs and characteristics of the information needs of subjects making strategic decisions. The responses from the structured interview also provided information about the strategic decision and the perceived quality of the strategic decision.

Demographics collected on all the subjects assisted in comparing the results of future research with the results of this research. Managers were chosen as subjects only if the manager had a minimum of one year's experience in making strategic decisions and a minimum of one year's experience in the real-world domain of responsibility chosen for the laboratory domain--the Director of DOE's Office of Nuclear Materials Production in 1988 and 1989.

4.3 Verbal Protocols as the Primary Research Data

The validity of the research results rests initially on the method chosen to collect the primary research data. As reviewed in Section 2.7, *Procedures for Studying Managers*, methods resulting in verbal protocols and methods utilizing information boards are the two accepted methods for studying cognitive processes. This research used concurrent verbalization as the primary method for collecting data about the information needs of nuclear GOA managers making strategic decisions.

4.3.1 Concurrent Verbalization as the Primary Data Collection Instrument

As presented in Section 2.7, *Procedures for Studying Managers*, many researchers of cognitive processes advocate a methodology that employs both verbal protocols and information boards (Payne et al., 1978; Payne, 1976; Newell & Simon, 1972). Information boards require the researcher to anticipate all the information the subject will require to make the decision and consequently constrain all the subjects to a given

set of information. The direction of research presented in this document is to describe the information needs of the subjects with minimal influence. Because there is no adequate theory of the information needs to allow design of the information boards with minimal influence, information boards are not used in this research.

Ericsson and Simon (1980) have analyzed the use of verbal protocols as data in research. There are two basic approaches to obtaining verbal protocols. Concurrent verbalization requires the subject to verbalize thought processes while executing some task. Retrospective verbalization requires the subject to verbalize thought processes at some time after the task is complete. Ericsson and Simon (1980) adopted the model of the person as an information processor developed by Newell and Simon (1972). Based on this model of how people think, verbalizations come from the person's short-term memory. This leads to the conclusion that verbal protocols best represent the thought processes when they are collected concurrently with the task or shortly after completion of the task. Ericsson and Simon (1980) support this conclusion with empirical evidence.

Concurrent verbalization places additional burden on the subject. Not only does the subject focus mental energy on the task of the exercise, but must also focus mental energy on verbalizing the thought processes. Ericsson and Simon (1980) developed three levels of verbalization based on the subject's need to recode the thought processes. Level 1 verbalization occurs when the subject's mental coding of the data to perform the task is verbal in nature and readily available in short-term memory such that the subject does not have to recode the data to verbalize it. Level 2 constitutes the situation where the subject's internal representation of the data is not verbal code and must be translated into verbal code. Level 3 represents the situation where the subject is asked to scan or filter the internal processes and select only certain data for verbalizing which may not be central or directly related to the subject's internal processes (Ericsson & Simon, 1980, pp. 218-220). Ericsson and Simon (1980) demonstrate with empirical evidence that level 1 and level 2 verbalizations reliably reflect the internal processes, whereas level 3 verbalizations are unreliable. Ericsson and Simon (1980) also report that intervention on the researcher's part to remind the subject to verbalize has been shown to have no significant effect on the results of the verbal protocol.

Based on the conclusions of Ericsson and Simon (1980), the approach for verbal protocols in this research was concurrent, level 1 and level 2 verbalizations. The elementary mental activities model developed in Chapter 3.0, *Research Concepts*, implies information needs are an integral part of the subject's mental strategic decision processes. This concept is consistent with the information processing model of internal

thought processes of Newell and Simon (1972). As such, requiring subjects to verbalize information needs concurrently while addressing a strategic exercise should result in a level 1 or level 2 verbalization resulting in reliable data.

4.3.2 Structured Interviews for Validity

As a form of retrospective verbalization of information needs, the structured interviews provide data which were used as evidence to assess the validity of both the verbal protocols and the coding of the verbal protocols. The details of the structured interview are presented in Section 4.7.6, *Structured Interview*. The initial question in the structured interview required the subject to engage in a form of retrospective verbalization of the just-completed task. Asking this question of the subject might force the subject into a level 3 verbalization which has been shown to result in data of undeterminable reliability when used by itself (Ericsson & Simon, 1980). However, comparing the subject's retrospective verbalization of information needs to the information needs determined by coding the verbal protocol provided the best available measure of confidence in the coded verbal protocol data. Ericsson and Simon (1980) have shown with empirical data that the sooner the retrospective verbalization follows the actual task, the better the reliability tends to be.

4.4 The Laboratory Environment

The laboratory environment consisted of the laboratory domain of responsibility and two aspects of reality: task reality and the actual exercise environment. The task reality was held constant by using the same description for the initial status of the complex of operating facilities for all subjects and strategic exercises.

The laboratory domain of responsibility was chosen to be the real-world domain of responsibility of the Director of the U. S. Department of Energy's Office of Nuclear Materials Production (NMP) in calendar years 1988 and 1989. At that time, the Director of NMP was responsible for three operating reactors and numerous other facilities for producing nuclear materials for defense purposes. The position and responsibilities were

clearly those of a nuclear GOA. The existence of three operating reactors and the turbulent environment surrounding the Director of NMP during 1988 and 1989 allowed flexibility to create a variety of realistic, strategic exercises for this experiment.

The actual exercise environment was constant regarding the information provided, the actions of the researcher, and the continuity of the experiment. The continuity was controlled by not allowing interruptions in the strategic exercise. Only one interruption was encountered and it was considered not to affect the results because it came at the end of an exercise during the description of the final decision. The actual place used for conducting the strategic exercise was the same for three out of the five subjects. The actions of the researcher were constant from subject to subject. The information provided was the same and was presented in the same order for all subjects.

4.5 The Subject's Experience and Personality

All the subjects' personalities are assumed to have no effect on the results of the exercises. The managerial characteristics of concern are the subject's experience in the Office of Nuclear Materials Production complex of facilities and their experience in strategic decision making. The criteria for a manager to become a subject were:

1. The manager must have worked in DOE's Office of Nuclear Materials Production or at one of the DOE sites heavily involved in the NMP mission for at least one year;
2. The manager must have at least one year's experience in making or directly involved in making strategic decisions involving NMP; and
3. The manager must have been involved in (1) and (2) above during some portion of the calendar years 1988 and 1989.

Pre-screening of managers ensured subjects met these criteria. Demographics taken in an entrance questionnaire provided a validity check to ascertain that these managers in fact met the aforementioned criteria.

4.6 Strategic Problems

As presented in Chapter 2.0, *Literature Review*, Section 2.3.2, *Strategic Problems*, and in Chapter 3.0, *Research Concepts*, Section 3.2.2, *Strategic Problems*, strategic problems typically result from the manager's reflections on units of information. Strategic problems trigger the manager to question the organization's strategy and to make decisions about the organization's strategy. Strategic problems, therefore, engage the manager in determining the fit between the organization and its environment.

To enhance the probability that the subjects' decision processes in the experiment are strategic, the question posed to the subject as part of the exercise was explicit and should have forced the subject to evaluate the organization's strategies. Each strategic exercise included the question and units of information termed a strategic scenario. The strategic scenario included the two problem components information and constraints.

The problems in each scenario posed to the subjects were designed to be strategic, varied, and realistic. These three attributes were partially validated using an exit questionnaire given to the subjects.

4.7 The Experiment

The following sections describe the procedures used to conduct the experiment.

4.7.1 Script for the Experiment

Figure 8, *The Research's Script for the Experiment*, and Figure 9, *The Research's Script for the Experiment (Continued)*, show the researcher's script for conducting the experiment. The script remained the same for each subject. The introduction section was designed to inform the subject of the experiment and to place the

Exercise Script

<<Hand the subject the PARTICIPANT'S INFORMED CONSENT>>

I'd like for you to read through this informed consent form. It informs you of your rights as a participant in this experiment. If there's something that's not clear, please ask me to clarify. After reading this, you are free to choose to participate or to not participate. If you choose to participate, please sign and date the form. I have an extra copy for you to keep.

I'm going to read this to you. This is the data collection portion of a research effort. All the managers in this portion of the research must hear the same words prior to and during this session. So forgive me for being so formal. After the session's complete, we can relax the conversation.

I'm going to ask that you not discuss this exercise with anyone except Dr. Kurstedt, Dr. Greene, Dr. Stout, or myself. You may tell others you participated, but please don't discuss the content of the exercises or convey some judgement that might bias their participation. Even if they are not a potential participant, they may talk with a participant and influence the results. You'll receive a copy of the research results. When you receive that copy, it will be okay to talk about the exercises with anyone.

My research is to uncover how managers formulate problems and problem solutions about nuclear issues. I'm interested in the information you need to determine what's going on and what changes you'd make in your operation to solve or mediate the situation. I'm also interested in the mental efforts you go through to process this information to make sense out of it and make conclusions.

First, I'm going to ask you some questions about your background and preferences--resumé-type questions. Second, you will do six exercises. Each exercise is like an emergency management table top exercise. I'll give you a scenario and you'll talk through what you'd do. We'll have a practice exercise first to get used to it. Then we'll go through five different exercises. Within each exercise is a scenario, a question, and instructions. After each exercise is complete, I'll ask you some questions about it. The questions aren't a test. There are no right or wrong answers, just some questions to try to get some additional information. The only constraint I'm putting on you is, as this sign says: Please, no classified data.

After each exercise, we'll take a 2 minute or longer break. Then after all the exercises are complete, I've got a couple exit questions for you to answer to evaluate the exercise.

I'll be recording most of this session. If I turn a tape over or jot down the time or some notes, don't let it bother you. This isn't a test of speed or accuracy. The times and notes will help me keep track of the transcripts.

<<Hand the subject the ENTRANCE QUESTIONNAIRE >>

First, I'd like to have you review and answer some questions about your background and experience. The information will be kept anonymous. I'm giving you the questions. What I'd like you to do is read each question out loud and answer it out loud. I'll record the answers and you won't have to write anything down.

I now will present you with a series of hypothetical scenarios (or sets of circumstances) and have you think aloud while you determine what the problem is and what plan of action you would follow. In other words, what you would you tell your managers to do and how will this affect NMP's normal operating strategies. When you think aloud, I'd like for you to tell me what you're thinking and what information you'd need to help you work through the exercise.

The exercise ends when you feel you know what information you need, or when you are prepared to make or in fact have made a strategic decision. After each exercise, I'll ask you to think back on what you did and answer some structured questions.

I'm not interested in assessing how well you do this. I'm not interested in assessing your success as a manager or how well you do this exercise. I'm interested in understanding the processes you use to think through problems and the information you need. Your responses will be anonymous. So, relax and let your mind go to work.

I'll give you an example exercise as practice. During the practice scenario, you may ask me questions. This is designed for you to get a feel for the experimental procedures.

<<Hand the subject the LABORATORY DOMAIN DESCRIPTION >>

Figure 8. The Researcher's Script for the Experiment

Here's your job and your complex which gives you the role to play and the initial status of your complex. I'll give you a copy to refer to throughout the experiment. It is the same for all the scenarios. I would like for you to read it out loud.

First I'll give you the exercise. Then I want you to imagine this is real. Try to picture in your mind you at your desk, as the Office Director of NMP, actually facing the events I describe. Please read the exercise description out loud and then think out loud while you work through the exercise.

<<Hand the subject the PRACTICE STRATEGIC EXERCISE)>>

<<REPEAT FOR EACH STRATEGIC EXERCISE>>
Good. I think we're ready to move to another scenario that reflects the nuclear materials production complex. First, I'll give you some time to review what your job is for the exercises and the initial status of your complex. Please read the description of your job and your complex out loud again.

<<Pause while the subject reviews the LABORATORY DOMAIN DESCRIPTION >>

<<Hand the subject the appropriate STRATEGIC EXERCISE >>

Now here's the <<first, second, third, fourth, or fifth>> exercise. Please read through the exercise out loud and then think out loud while you work through the exercise.

Now I'll ask you some questions about this exercise.

<<Hand the subject Part I of the STRUCTURED INTERVIEW. Read the question and have them write the answer. Then hand them Part II. Read the questions and let them answer each. Then hand them Part III. Read the questions and let them answer each.>>

Thank you. Now let's take at least a 2 minute break. (Ask how long the subject manager would like, and coordinate the break.)

<<Hand the subject the EXIT QUESTIONNAIRE >>

That's it. I just have one more set of questions for you to answer about the exercise. This won't take long. This time, I'll give you the questions and you can either write the answers or answer them out loud. If you choose to answer them out loud, please read the question or question number out loud so when I'm transcribing the tape, I'll know for sure what answer goes with what question.

Thank you for your time and patience. Once again, I'm going to ask that you not discuss this exercise with anyone except Dr. Kurstedt, Dr. Greene, Dr. Stout, or myself. You may tell others you participated, but please don't discuss the content of the exercises or convey some judgement that might bias their participation. Even if they are not a potential participant, they may talk with a participant and influence the results. You'll receive a copy of the research results. When you receive that copy, it will be okay to talk about the exercises with anyone.

Figure 9. The Researcher's Script for the Experiment (Continued)

subject at ease. Breaks were allowed after each structured interview. The length and content of the breaks are assumed to have no affect on the experiment. The minimum break time was two minutes after each structured interview.

4.7.2 Entrance Questionnaire

The questions shown in Figure 10, *The Entrance Questions*, are from the entrance questionnaire given to all subjects at the beginning of the experiment. The subject was asked to read the questions aloud and to answer the questions aloud. The subject's responses were tape recorded and transcribed. Question one captures the formal education of the manager. Questions two and three capture the manager's current position and position description. Questions four through eight were designed to collect information pertaining to the subject's experience in the laboratory domain of responsibility and the subject's strategic decision making experience. The subject's responses to these questions were used to verify whether or not the manager was an acceptable subject for this research.

The subject's personality was assessed using questions nine through eleven. If the subject likes making strategic decisions, the subject is most likely a strategist according to the typing of Ramaprasad and Mitroff (1984). Preferring bottom-lines to detailed data would indicate the manager is more likely intuitive rather than sensing. Preferring graphs over tables tends to indicate the subject's cognitive style. The answers to three questions do not allow accurate typing of the subject's personality, but will provide some measure of the subject's personality traits considered to possibly have an affect on the subject's strategic decision making processes.

The subject's answer to question twelve indicates the type of mental coding the subject might use in short-term memory. If the subject more often draws pictures, the subject is more likely to code decision making information graphically. Translating the graphical coding into verbalizations would imply a level 2 verbalization. On the other hand, if the subject more often writes words, then the subject is more likely to code information verbally. This situation would result in a level 1 verbalization. The response to this question should also provide insight when compared to the amount and nature of the information the subject verbalized during the experiment.

Entrance Questions and Demographic Data

1. What formal education have you had since high school? Please give degrees, majors, and schools.

2. What is your current position?
   Company:_____
   Organization: _____
   Position Title: _____
   Length of time in this Position: _____

3. What are your responsibilities in your current position?

4. Have you ever been the Office Director of DOE's Office of Nuclear Materials Production (NMP)? If so, when and for how long?

5. Have you ever been in a position that reports to or works closely with the Office Director of NMP's Office of Nuclear Materials Production? If so, when and for how long?

6. Have you made or played a significant role in making decisions affecting the long-term operations of the Nuclear Materials Production Complex? (Yes or No)

   How long were you or how long have you been in the position of making these decisions?

   Please briefly describe several of the decisions you made or helped make.

7. In your current job or in previous jobs, have you made or played a significant role in making decisions affecting the long-term strategies, goals, objectives, or operation of your organization? If so, when and for how long?

   Please describe several of the decisions you made or helped make.

8. Have you been in a position other than the Office Director of NMP with managerial responsibilities for facilities within the nuclear materials production complex? If yes, when and for how long?

9. How often do you procrastinate in making high-level decisions about the NMP Complex?
   a. Always
   b. Usually
   c. Sometimes
   d. Seldom
   e. Almost never
   f. Never

10. Would you welcome the chance to make more high-level decisions about the NMP Complex?
    a. Yes
    b. Probably yes
    c. Probably no
    d. No

Figure 10. The Entrance Questions

11. How did you feel about making high-level decisions about the NMP Complex?
    a. Very good
    b. Fairly good
    c. About average
    d. Not too good
    e. Not at all good

12. When you get information to support high-level decisions, do you like to examine the detailed numbers?
    a. Always
    b. Usually
    c. Sometimes
    d. Seldom
    e. Almost never
    f. Never

13. When you are making high-level decisions, do you like for your staff to give you the bottom-line up-front?
    a. Always
    b. Usually
    c. Sometimes
    d. Seldom
    e. Almost never
    f. Never

14. When you get information to support high-level decisions, do you like to look at graphs?
    a. Always
    b. Usually
    c. Sometimes
    d. Seldom
    e. Almost never
    f. Never

15. When you get information to support high-level decisions, do you like to look at tables?
    a. Always
    b. Usually
    c. Sometimes
    d. Seldom
    e. Almost never
    f. Never

16. When you think through a difficult problem, how often do you draw pictures to help you think through the problem?
    a. Always
    b. Usually
    c. Sometimes
    d. Seldom
    e. Almost never
    f. Never

17. When you think through a difficult problem, how often do you write words to help you think through the problem?
    a. Always
    b. Usually
    c. Sometimes
    d. Seldom
    e. Almost never
    f. Never

Figure 10. The Entrance Questions (Continued)

4.7.3 Laboratory Domain and Initial Status

Figure 11, *The Laboratory Domain and Initial Status Description*, shows the description of the laboratory domain of responsibility given to the subjects. This domain was the same for all subjects and all strategic problems. Though it is a brief description, the managers chosen as subjects for the pilot and final studies had experience either as the Director of NMP during 1988 or 1989, or they reported to, worked closely with, or supervised the Director of NMP during that time. Therefore, the brief description and the terms used were adequate.

The initial status of the NMP complex of facilities is also shown in Figure 11, *The Laboratory Domain and Initial Status Description*, as a part of the description of the subject's job and complex. To avoid the use of classified data, the initial status did not represent an actual status. It represented a realistic composite of individual facility situations which could have been possible during that time.

4.7.4 Practice Strategic Exercise

Figure 12, *The Practice Exercise*, shows the practice strategic exercise. The purpose of the practice exercise was to allow the subject to get comfortable with verbalizing the thinking process. It offered an opportunity for the subject to ask questions of the researcher about the process of verbalizing. The researcher was consistent in responding to different subject's questions. The purpose was not to impose constraints on the subject or lead the subject into providing the type of verbalizations the researcher preferred. The purpose was to give the subject a chance to become used to verbalizing the thought process.

4.7.5 Strategic Exercises

The five strategic exercises used in the experiment are presented in Figure 13, *Strategic Exercises*, and Figure 14, *Strategic Exercises (Continued)*. The strategic exercises were adjusted in the pilot study based on the responses to the exit questionnaire.

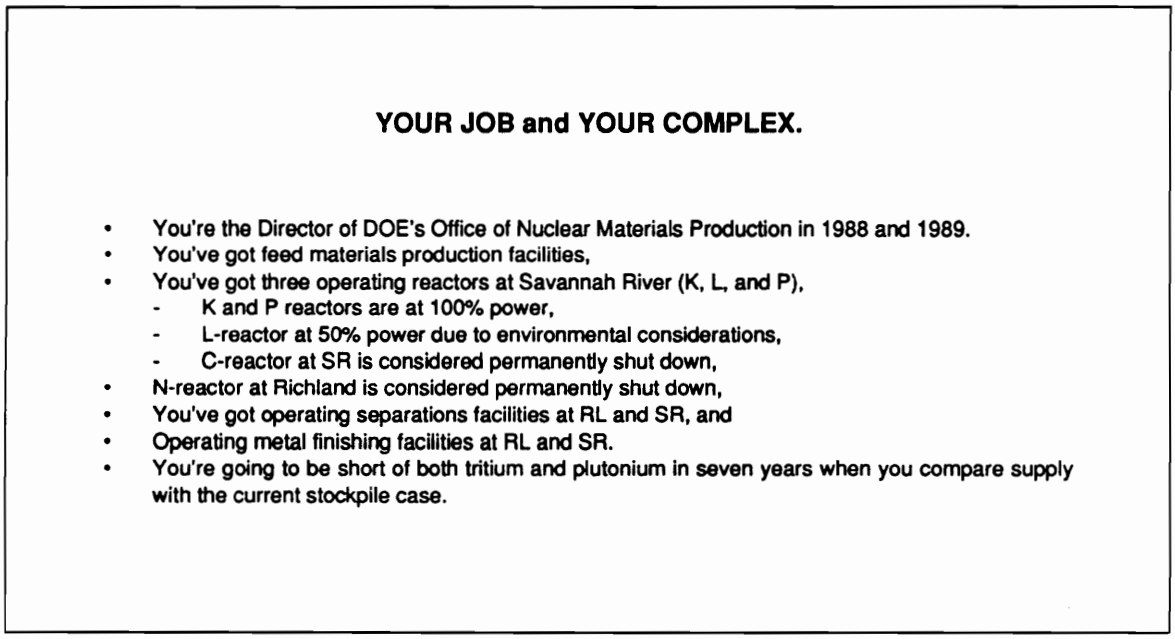


Figure 11. The Laboratory Domain and Initial Status Description

PRACTICE EXERCISE

Scenario:

- Recently you've read in the newspaper that environmental activists groups plan to picket the Savannah River Plant this week.
- Your Deputy Director just informed you they had to shut down one of the SR reactors.

Question:

- What are you going to tell your managers to do and how will this affect NMP's normal operating strategies?

Instructions:

- Think aloud as you work through the exercise to arrive at a decision you'd make or a recommendation you'd make to your superiors.

Figure 12. The Practice Exercise

STRATEGIC EXERCISE 1

Scenario:

- Gorbachev and President Bush are in serious arms limitations talks.
- Some key members of congress are reportedly pushing to cut DOE's budget by 25% to rid the DOE of waste, fraud, and abuse.
- Last week the Washington Post reported yet another incident of contamination from the Rocky Flats Plant.
- Your Deputy just informed you one of the SR reactors was just shut down.

Question:

- What are you going to tell your managers to do and how will this affect NMP's normal operating strategies?

Instructions:

- Think aloud as you work through the exercise to arrive at a decision you'd make or a recommendation you'd make to your superiors.

STRAGEGIC EXERCISE 2

Scenario:

- Gorbachev and President Bush have agreed to reduce the number of nuclear weapons in Europe.
- Last week, FBI agents seized the Rocky Flats Plant and secured all files.
- K-reactor is down with problems.
- N-reactor and L-reactor are still operating normally.
- You just found out the Washington Post has run an article stating they have an internal DOE contractor memo stating the safety analyses performed when the reactors were designed is inadequate by today's standards.

Question:

- What are you going to tell your managers to do and how will this affect NMP's normal operating strategies?

Instructions:

- Think aloud as you work through the exercise to arrive at a decision you'd make or a recommendation you'd make to your superiors.

STRAGEGIC EXERCISE 3

Scenario:

- The governor of Ohio has just stopped all shipments of nuclear materials through the state until FMPC is cleaned up.
- Last week, there was a leak from one of the tanks at FMPC.
- All the reactors are down at SR.
- You just returned from Forrestal where you heard rumors of a reorganization because of all the problems with the production complexes.
- In a meeting at Forrestal today, the Deputy Assistant Secretary for Military Applications expressed displeasure with you for not being able to produce enough material to meet peg points.

Question:

- What are you going to tell your managers to do and how will this affect NMP's normal operating strategies?

Instructions:

- Think aloud as you work through the exercise to arrive at a decision you'd make or a recommendation you'd make to your superiors.

Figure 13. Strategic Exercises

STRAGEGIC EXERCISE 4

Scenario:

- The presidential elections are over and George Bush won.
- DOE environmental managers have won against you in an internal battle ending with the Secretary shutting down all the reactors for an environmental review.
- Some congressmen are still pushing a new production reactor capability.
- You've just been notified you must testify before the House Armed Services Committee about your ability to meet national security requirements.

Question:

- What are you going to tell your managers to do and how will this affect NMP's normal operating strategies?

Instructions

- Think aloud as you work through the exercise to arrive at a decision you'd make or a recommendation you'd make to your superiors.

STRAGEGIC EXERCISE 5

Scenario:

- WIPP is not going to come on-line anywhere near the estimated time, and the rumor is it may never come on-line.
- All the reactors have been shut down for environmental review and the Secretary has said in several meetings that he intends to create a special task force for restarting them.
- A recent report by one of your division directors indicated major break-through's in SIS technologies.
- There are at least two new stockpile cases a week because of the suspected U.S.-Soviet agreements resulting from various Bush-Gorbachev talks.

Question:

- What are you going to tell your managers to do and how will this affect NMP's normal operating strategies?

Instructions

- Think aloud as you work through the exercise to arrive at a decision you'd make or a recommendation you'd make to your superiors.

Figure 14. Strategic Exercises (Continued)

These five exercises were reviewed prior to the pilot study by people who've worked closely with DOE's Office of Nuclear Materials Production and were shown to be both varied and realistic problems. The definition of strategic problems presented in Section 4.6, *Strategic Problems*, indicates the five problems represented in the exercises are strategic problems by virtue of the explicit question to evaluate the scenario impact on operating strategies posed to the subject.

4.7.6 Structured Interview

Figure 15, *Part I and Part III of the Structured Interview Questions*, and Figure 16, *Part II of the Structured Interview Questions*, show the questions involved in the structured interview. There were three basic parts to the structured interview. The first part consisted of asking the subject to think back on the strategic decision making task just completed and verbalize the key pieces of information needed. The subject's response to this question were used to validate the coded verbal protocol.

The second part in the structured interview could be used to assign information characteristics to the information needs in further research efforts. The second set of questions were asked once for each unit of information the subject identified in Part I.

The third part shown in Figure 15, *Part I and Part III of the Structured Interview Questions*, was used to collect the subject's perception of how confident he/she is in the final decisions and how good he/she feels about the decision. The subject's responses to these questions were designed to validate the coding and to enable the researcher to verify the subject's mental decision processes as strategic.

4.7.7 Exit Questionnaire

The validity of the exercises as to whether or not they are realistic, strategic, and varied resulted from analyzing the subject's responses to the exit questions shown in Figure 17, *The Exit Questions*. Question 7 provided an opportunity for the subject to comment on any aspect of the experiment.

STRUCTURED INTERVIEW QUESTIONS

PART I.

1.0 Thinking back on the scenario you just worked through, list the key pieces of information you'd need to solve the problem.

PART III.

3.0 Describe the final decision you made.

3.1 How confident are you in that decision?
- a. Very confident
- b. Moderately confident
- c. Somewhat confident
- d. Not confident

3.2 Do you feel it was a good decision?
- a. Very good
- b. Good
- c. Fair
- d. Poor

Figure 15. Part I and Part III of the Structured Interview Questions

STRUCTURED INTERVIEW QUESTIONS

PART II.

For the information you listed:

2.1 How old can the information be?

2.2 How precise does the information need to be?

I'm going to ask you two related questions. The first has to do with who or what generates the information you need while the second question has to do with who or what communicates the information directly to you.

2.3 Where would you want the information to originate?

2.4 Where would you want the information to come from?

2.5 How would you want the information presented to you? For example, on paper or verbally?

2.6 How long would you be willing to wait for this information before you took action?

2.7 How important is this information to the final decision you make?

Figure 16. Part II of the Structured Interview Questions

EXIT QUESTIONS

1. Did the exercises stimulate the kind of thinking that you did when you were, or when you supported, the Director of the Office of Nuclear Materials Production? (Yes or No) Why?

2. Did the exercises represent problems the Director of the Office of Nuclear Materials Production might actually face or might have actually faced in the past? (Yes or No) Why?

3. Were the exercises representative of the variety of high-level problems the Director of the Office of Nuclear Materials Production might actually face or might have actually faced in the past? (Yes or No) Why?

4. Would you consider the scenarios in the exercises as strategic scenarios? (Yes or No) Why?

5. Were the exercises challenging? (Yes or No) Why?

6. If you faced these scenarios in the real-world, do you think your responses would be different? (Yes or No) Why and how?

7. Additional Comments:

_____

Figure 17. The Exit Questions

4.8 Data Reduction

The data collected in the experiment fall into three major categories:

1. interview data: collected using the Entrance Questionnaire, the Structured Interview for each exercise, and the Exit Questionnaire;
2. scenario data: resulting from the coding the base description of the domain and the five scenarios given to the subjects in the exercises; and
3. coded protocol data: resulting from coding the transcripts of the subjects' verbalizations during the exercises.

The data generated in the experiment and used for analyses are presented in the appendices. The order of presentation generally follows the order of the experiment with the Entrance Questionnaires in Appendix A, *Entrance Questionnaires*, the transcripts, translations, and coded protocols in Appendix B, *Transcripts, Translations, and Coded Protocols*, the resulting lists of unique units of information in Appendix C, *Lists of Unique Units of Information*, the Structured Interviews in Appendix D, *Structured Interviews*, and the Exit Questionnaires in Appendix E, *Exit Questionnaires*.

Analyses of the interview data utilize the data as transcribed with no reduction procedures. The analyses are presented in Chapter 5.0, *Results and Specific Analyses*.

Once the subjects' verbalizations are transcribed, the procedures for reducing the scenario data and the subjects' verbalizations are the same. Though the following presentation addresses only the reduction of the subjects' verbalizations, the scenario data were reduced in the same fashion.

The procedures for reducing the subject's verbalizations as recorded on magnetic tape were transcribed to produce written records. Then the transcripts were translated and coded resulting in a set of coded protocols. Figure 18, *Portions of a Verbal Protocol From Strategic Exercise One*, shows a portion of a transcript, the translation, and the coded protocol of a subject performing the first exercise.

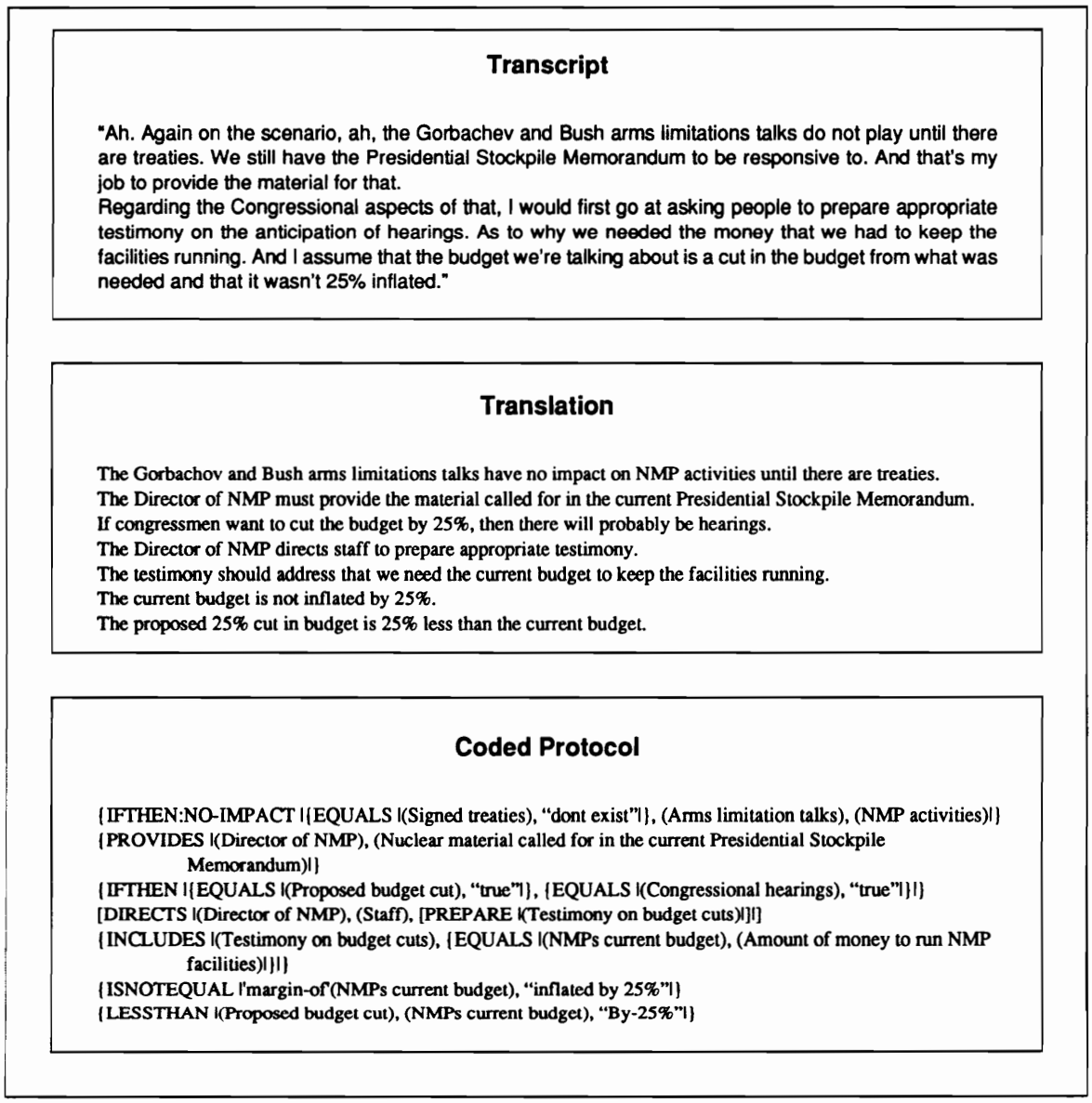


Figure 18. Portions of a Verbal Protocol from Strategic Exercise One

During the coding process, lists of unique units of information were maintained. After the transcripts for all exercises for all subjects were coded, information characteristics were assigned to the units of information in the unique lists and the usage of each unit of information was calculated. The coded protocols, lists of unique units of information with assigned information characteristics and the usage tables formed the databases used in the data analyses which are presented in Chapter 5.0, *Results and Specific Analyses*. The following sections describe the procedures in more detail.

4.8.1 Transcribing

Two microcassette recorders were used to record the subjects verbalizations to guard against mechanical problems affecting the recordings. After the subjects' verbalizations were transcribed for each exercise, the tapes were reviewed and the transcripts checked for possible transcription errors. In several cases, the second tape was used to fill in gaps in the recordings when the end of a tape was encountered. An example of a portion of a transcript is shown in Figure 18, *Portions of a Verbal Protocol From Strategic Exercise One.*

4.8.2 Translating

The translation of the transcripts introduces the most subjectivity of the steps in the procedure. Translation was necessary for the following reasons:

1. to resolve incomplete or unclear references,
2. to resolve multiple references to the same thing using different words,
3. to simplify compound and complex sentence structures, and
4. to eliminate non-essential words and phrases.

Translating the transcript required extensive knowledge of the laboratory domain of responsibility.

Translation was accomplished by establishing a translation table for each transcript and then by applying the translation table to the transcript. An example of a portion of a translation is shown in Figure 18, *Portions of a Verbal Protocol From Strategic Exercise One.*

4.8.1 Coding

Each sentence in the translation was coded to create the coded protocol. An example of a portion of a coded protocol is shown in Figure 18, *Portions of a Verbal Protocol From Strategic Exercise One.* The procedures for coding the translations are presented below.

The coding unit was a phrase. Each phrase was evaluated according to the coding rules to determine the types of information--entities, relationships, operators, and attributes of each--contained in the phrase. During the pilot study, the values type of information was identified as distinct from the other types of information. Values were then included in the rules and syntax for coding translations. Also during the pilot study, it was determined that desired outcomes and model outcome predictions are characteristics of types of information as opposed to being distinct types of information.

The coding rules and the syntax for coding are closely related. The coding used is based on the basic rules of predicate calculus. The general coding rules used are:

1. Entities are objects, e.g., uranium, a person, a nuclear reactor, the supply of nuclear material;
2. Relationships describe the interaction between two or more entities and/or attributes of entities and can take the form of algebraic or propositional relations, e.g., when the demand for uranium increases, the supply of uranium increases;
3. Operators are relationships which are imposed on reality representing a departure from normality, e.g., the Secretary of Energy decided to shut down all the reactors;
4. Attributes are characteristics of entities, relationships, or operators, e.g., the estimated time to restart a reactor is 10 days; and
5. Values are the result of a qualitative or quantitative measure of attributes of entities, relationships, or operators, e.g., the value in the sentence "the estimated time to restart a reactor is 10 days" is "10 days".

The types of information are interrelated. Figure 19, *The Interrelatedness of Types of Information*, shows the types and their interrelatedness. Relationships and operators are composed of a relator (or operator) and values, entities, other relationships, other operators, and/or attributes applied to entities, other relationships, and other operators. Because of this interrelatedness, it was necessary to identify and label the entities, values,

and attributes before identifying and labeling the relationships and operators. Because relationships and operators can be nested, i.e., references to relationships within relationships, two passes were required through the phrases to ensure correct identification and labeling of relationships and operators.

The coding syntax closely follows the language syntax for LISP, a computer programming language used in many artificial intelligence applications. The coding syntax rules are:

1. Entities:
   - Enclosed in parentheses, e.g., (Signed treaties),
   - Label begins with "E" followed by a number to create a unique reference and enclosed in parentheses, e.g., (E1);
2. Values:
   - Enclosed in double quote marks, e.g., "10 days",
   - Label begins with "V" followed by a number to create a unique reference, e.g., V3;
3. Attributes:
   - Enclosed in single quote marks, and it is preferable that the words are connected with hyphens, e.g., 'status-of',
   - When modifying a relationship or operator, the attribute is followed by a comma, e.g., 'plan-for',[RESTART |(Reactors)|],
   - When modifying an entity, the attribute is not followed by a comma, e.g., 'feelings-of'(Director of NMP),
   - Label begins with "A" followed by a number to create a unique reference;
4. Relationships:
   - Enclosed in curly brackets, e.g., {EQUALS |'status-of'(Reactor), "operating"|},
   - Relator is capitalized, followed by a space and a bar, e.g., {EQUALS |,
   - Argument of the relationship is enclosed by bars, e.g., |'status-of'(Reactor), "operating"|,
   - Parameters of the argument are separated with a comma followed by a space, e.g., (Reactor), "operating",
5. Operators:
   - Enclosed in square brackets, e.g., [RESTARTS |(Director of NMP), (Reactors)|],
   - Operator is capitalized, followed by a space and a bar, e.g., [RESTARTS |,
   - Argument of the operator is enclosed by bars, e.g., |(Director of NMP), (Reactors)|,

- Parameters of the argument are separated with a comma followed by a space, e.g., (Director of NMP), (Reactors).

The form of the coded protocols in the above examples, presented in Appendix B, uses the descriptions of the entities, values, attributes, relationships, and operators. The form of the coded protocols shown in Figure 19, *The Interrelatedness of Types of Information*, uses the labels of entities, values, attributes, relationships, and operators. The form of the coded protocol is important in the programming for determining uniqueness and in conducting the data analyses.

The data base of coded protocols contains 1,230 coded sentences. The distribution of the sentences by subject and by exercise is shown in Table 4, *The Number of Sentences Coded and Units of Information in the Unique Lists.*

4.8.3 Verification

The information identified by the subject in Part I of the Structured Interview was compared with the information identified in the transcripts and coded protocols. For four of the five subjects, all the information in Part I of the Structured Interview was found in the transcripts and coded protocols. One subject continued to think through the problem when presented Part I of the Structured Interview. In this case, the subject was not simply rethinking the problem. The subject addressed parts of the scenario that were not addressed in the verbalizations for the exercise. For this subject, the transcripts of the subject's verbalizations during Part I of the Structured Interview were included in the transcripts for each exercise.

4.8.4 Unique Lists

During the coding procedures, lists of unique units of information were maintained by type of information. The final lists are presented in Appendix C, *Lists of Unique Units of Information.* Several checks and balances were instituted to ensure the integrity of the unique lists. A syntax checker and table lookup capability were programmed to check the coding tables prior to the application of the coding tables. After the coding table

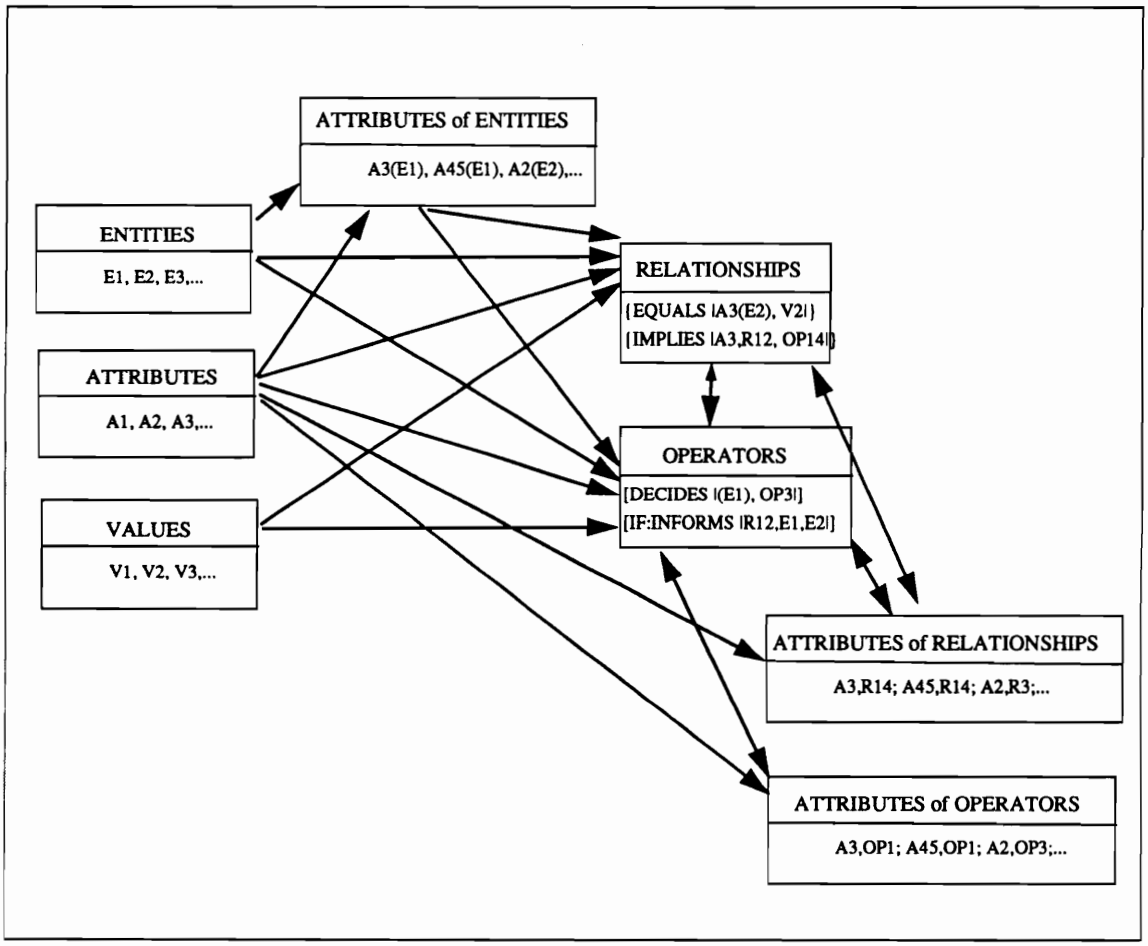


Figure 19. The Interrelatedness of Types of Information

was applied to the transcript, a program identified the new units of information and suggested additions to the unique lists, which were reviewed prior to their inclusion to the lists. Finally, after information characteristics were assigned, several views of the units of information were reviewed again for uniqueness, exceptions resolved, and the protocols re-coded using the resolved, unique lists. The result was that 2,558 unique units of information were identified. The distribution of the unique units of information by type of information is shown in Table 4, *The Number of Sentences Coded and Units of Information in the Unique Lists.*

4.8.5 Assigning Information Characteristics

A list of information characteristics was presented in Chapter 3.0, *Research Concepts*, Section 3.5, *Strategic Information*. It was possible to assign all of these characteristics of information to at least one type of information in the unique lists. Some considerations for assigning information characteristics follow.

In some cases, a characteristic of information has no meaning for a particular type of information. For example, level of detail has meaning for entities, such as a particular reactor. However, level of detail has no meaning for attributes, such as "feelings-of." Level of detail would have meaning for attributes only when they are coupled with the entities they modify. For example, the "feelings-of"(The Secretary of Energy) would be considered on a different level of detail than the "feelings-of"(The Reactor Division Director).

In some cases, the meaning of a particular characteristic of information for a relationship or for an operator is related to the assignment of the particular characteristic of information to the types of information that comprise the relationship or operator. For example, the level of detail of a relationship is determined by considering the level of detail of the entities referenced in the relationship. This is the case for all the characteristics of information assignable to relationships and operators except for those characteristics of information, such as class, whose value depends on the relator or operator, i.e., the verb, employed in the relationship or operator.

Table 4. The Number of Sentences Coded and Units of Information in the Unique Lists

NUMBER OF SENTENCES CODED

	Base	Scenarios	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Totals
	25							25
Exercise 1		9	15	50	108	53	22	257
Exercise 2		11	17	61	47	32	32	200
Exercise 3		10	34	98	80	40	33	295
Exercise 4		8	23	59	61	23	24	198
Exercise 5		12	30	96	62	29	26	255
Subtotals	25	50	119	364	358	177	137	1,230

NUMBER OF UNITS OF INFORMATION IN UNIQUE LISTS

TYPE	UNITS OF INFORMATION
Values	276
Attributes	131
Entities	270
Relationships	870
Operators	1,011
Total	2,558

Information characteristics were chosen and assigned to the unique lists of entities, relationships, and operators to demonstrate the possibilities for data analyses. Four information characteristics were chosen for entities and three information characteristics for relationships and operators.

4.8.5.1 Information Characteristics Assigned to Entities

The information characteristics assigned to entities were:

1. Source: where the entity originated--whether in the base description, one of the scenarios, or from a subject;
2. Level of detail: from the perspective of the Director of the Office of Nuclear Materials Production, the grain size of the structural description necessary to yield the entity as a unit of information;
3. Class: the generic group of entities to which the specific entity belongs; and
4. Internal/external: whether the entity exists within or outside of the domain of responsibility of Director of the Office of Nuclear Materials Production.

The scales and rules for assigning the values of the information characteristics to entities follow.

1. Source:
   - The value of source equals "Base" if the entity was used in the initial status description of the laboratory domain.
   - The value of source equals "Scenario" if the entity was not used in the initial status description of the laboratory domain, but was used in the scenarios for any of the exercises.
   - The value of source equals "Non-exercise" if the entity was not used in the initial status description of the laboratory domain and if it was not used in the scenarios for any of the exercises, but it was used by at least one subject in one exercise.
2. Level of Detail:

   In qualitative physics terminology, the level of detail of a unit of information is equal to the grain size of the structural description of the system that would yield the unit of information. The level of detail is relative to the perspective of the manager's position. The values of level of detail for entities were determined iteratively along with determining the class of the entity. Particular classes were established for the laboratory domain by examining the data in light of the domain knowledge of the researcher.

Under each class, where needed, sub-classes were established. Entities belonging to the first level of classes were assigned a level one value. Entities belonging the next level of classes, or sub-classes were assigned a value of level two, and so forth.

For example, for the laboratory domain of responsibility, "NMP facilities" and "OMA facilities" were established as particular classes of entities. Under the class "NMP facilities" were established "Reactors" and "Separations Facilities" classes. Entities pertaining to the NMP facilities in general would fall directly under the "NMP facilities" class and would be assigned a value of one for level of detail. Entities referring to all reactors in general would fall under the "Reactors" class and would be assigned a value of two for level of detail. Classes and sub-classes were established for all entities in the unique list. The list was sorted by class, reviewed, corrected by separating unlike entities by establishing new classes or sub-classes, and corrected by grouping like entities by combining classes and sub-classes. The assignment of level of detail and class was iterated seven times to create the current structure. The presentation of the list of unique entities in Appendix C, *Lists of Unique Units of Information*, shows the structure and relationships of the classes and sub-classes of entities with level of detail.

3. Class of Entities:

   The classes of entities particular to the laboratory domain established to determine level of detail were examined to create a list of generic classes. For example, "NMP facilities" and "OMA facilities" were grouped to establish the generic class of "Facilities." In this manner, the generic classes were initially established. The entities were grouped under each generic class and the list was reviewed. Inconsistencies were resolved, the entities re-grouped, and the list reviewed again. This procedure was repeated three times to establish the list of classes of entities which follows.

   - Classes of Entities
     - Activities
     - Country
     - Decisions
     - Environment
     - Facilities
     - Incidents
     - Information

- People
- Products
- Resources
- Sites

4. Internal/external:
   - The value of internal/external equals "internal" if the entity is within the domain of responsibility of the Director of the Office of Nuclear Materials Production.
   - The value of internal/external equals "external" if the entity is not within the domain of responsibility of the Director of the Office of Nuclear Materials Production.
   - The value of internal/external equals "both" if the entity could be either internal to or external to the domain of responsibility of the Director of the Office of Nuclear Materials Production.

   The value of "both" was assigned to generic entities, such as "rumors," "someone," and "facilities," used by the subjects.

4.8.5.2 Information Characteristics Assigned to Relationships and Operators.

The information characteristics assigned to both relationships and operators were:

1. class: the generic group of relationships or operators to which the relationship or operator belongs;
2. internal/external: whether the relationship or operator involves entities which exist within, outside, or both within and outside of the domain of responsibility of Director of the Office of Nuclear Materials Production; and
3. relationship complexity: the number of relationships and operators within the particular relationship or operator.

The scales and rules for assigning the values to the information characteristics for relationships and operators follow.

1. Class:

   The classes of both relationships and operators were established by creating lists of unique verbs used in each. The list of verbs for each was reviewed and an initial list of classes established. Then the verbs were grouped with the classes and reviewed. Inconsistencies in classes were resolved and the verbs reassigned. Five iterations of assignment and review were conducted for relationships and five iterations for operators. Once the verbs were linked with classes, programs were developed to assign the class to all relationships and operators by virtue of the verb used in the relationship or operator. The classes of relationships and operators follow.

   - Classes of Relationships
     - Assignment
     - Impact
     - Implication
     - Order
     - Ownership
   - Classes of Operators
     - Alters
     - Believes
     - Communicates
     - Decides
     - Directs
     - Evaluates
     - Informs
     - Inquires
     - Knows
     - Needs
     - Prepares
     - Wants

2. Internal/external:

   - The value of internal/external equals "internal" if all entities referenced in the relationship or operator have an internal/external value of "internal."

- The value of internal/external equals "external" if all entities referenced in the relationship or operator have an internal/external value of "external."
- The value of internal/external equals "both" if at least one entity referenced in the relationship or operator has an internal/external value of "both," or if entities referenced in the relationship have internal/external values of "internal" and "external."

3. Relationship complexity:
   - The value of relationship complexity equals the number of relationships and/or operators referenced in the relationship or operator plus one. Therefore the minimum value of relationship complexity is one.

4.8.6 Determining Usage of Units of Information

Two forms of usage of each type of information were calculated. By examining the coded protocols, the number of references to each, unique value, attribute, entity, relationship, and operator was determined for each subject and exercise. This created a series of usage tables with the term "use" defined as the number of references to each unit of information and labeled "frequency of use." A second set of usage tables was then generated with the term "use" defined according to a binary scale--either the subject used the unit of information in the exercise (use = 1) or the subject did not use the unit of information in the exercise (use = 0), and labeled "use." Both sets of tables were employed in the data analyses.

4.9 Databases and Tools

Reduction of the subject's verbalizations during the exercises created three databases for use in the data analyses: coded protocols, unique lists with information characteristics, and usage tables. The databases were created and maintained using Wingz™[1] on a NeXT™[2] computer. Programs were written in HyperScript®[3] to assist in the following activities:

- managing the data files,
- translating the transcripts,
- coding the transcripts,
- checking the syntax,
- identifying and defining relationships and operators,
- determining the uniqueness of units of information,
- updating the lists of unique units of information by type,
- assigning information characteristics to the units of information,
- determining the two forms of use of the units of information,
- sorting and selecting units of information based on information characteristics,
- calculating descriptive statistics, and
- graphing and displaying the data and the results of the analyses.

In each case when a program was used to assist an activity, the accuracy of the program activity was desk checked using at least five different samples.

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1. Wingz is a trademark of Informix Software, Inc.
2. NeXT is a trademark of Next, Inc.
3. HyperScript is a registered trademark of Informix Software, Inc.

5.0 RESULTS AND SPECIFIC ANALYSES

5.1 Overview

The raw data generated in the experiment and used for analyses are presented in the appendices. The data collected in the experiment fall into three major categories:

1. interview data: collected using the Entrance Questionnaire, the Structured Interview for each exercise, and the Exit Questionnaire;
2. scenario data: resulting from coding the five scenarios given to subjects in the exercises; and
3. coded protocol data: resulting from coding the transcripts of the subjects' verbalizations during the exercises.

Data analyses using each type of raw data are presented in the following sections along with the subsequent results in the form of empirical generalizations.

These results lead to specific and general conclusions presented in Chapter 6.0, *Analysis and Implications*. The specific and general conclusions in Chapter 6.0, *Analysis and Implications*, answer the question, "So what?" which naturally follows from the presentation of the results.

5.2 Analysis of Interview Data

There were three types of interviews with each subject. The Entrance Questionnaire was used to qualify and characterize the subjects. The Structured Interview for each exercise was used to verify the coded protocol data, to collect additional information characteristics to be used in further research, and to capture the subject's description of the decisions made. The Exit Questionnaire was used to assess the characteristics of the experiment.

5.2.1 Entrance Questionnaires

The responses to the Entrance Questionnaire are presented in Appendix A. Analyzing the subjects' responses to the questions yielded the following results.

1. All subjects have bachelors degrees in technical disciplines.
2. All subjects have formal education beyond the bachelors degree.
3. Four out of five subjects work for the United States Department of Energy (DOE).
4. All subjects have either been the Director of NMP and/or worked closely with the Director of NMP.
5. Two subjects were the Director of the Office of Nuclear Materials (NMP) at some time and one was the Director of NMP's boss.
6. All subjects have played a significant role in making decisions affecting the long-term operations of NMP's complex of facilities.
7. The subjects have had at least two years and averaged four years experience playing a significant role in making long-term operations of NMP's complex of facilities.
8. All subjects have played a significant role in making decisions affecting the long-term strategies, goals, objectives, or operation of their organization for at least three years with an average of five and one half years experience.
9. Four out of five subjects have additional experience in decision making positions involving NMP's complex of facilities. Of these subjects the minimum time of experience was four years.
10. Three of the five subjects like making strategic decisions.
11. Two of the five subjects are probably intuitive and two others responded in a manner that slightly favored the intuitive side, while the remaining subject responded equally to questions of details versus bottom-lines.
12. Three of the subjects chose graphs and tables equally while the other two subjects preferred graphs.
13. Two subjects probably use graphical coding in short-term memory and one subject probably uses verbal coding, while the remaining two subjects responded equally to the questions.

5.2.2 Structured Interviews

The responses to the Structured Interviews are presented in Appendix D, *Structured Interviews.*

Part I of the Structured Interview was used to partially verify the coding of the protocols. For each exercise, the information listed in Part I was found to be contained in both the subject's verbalization and the coded protocol.

Part II of the Structured Interviews was used to collect information characteristics that could be determined only by the subject. It was important to collect the data about these characteristics as soon after the task completion as possible. Part II of the Structured Interviews was conducted during the experiment. However, these data did not need to be analyzed to accomplish the scope of this research. In further research efforts, the responses should be analyzed and values of information characteristics determined and assigned to the unique lists of entities, relationships, and operators.

Part III of the Structured Interviews was used to collect data about the subject's decisions. In all cases, since the only information provided during the exercise was the information in the scenario, the subjects were only able to make decisions to collect more information rather than to make a final decision about the scenario.

5.2.3 Exit Questionnaires

The responses to the Exit Questionnaires are presented in Appendix E. Analyzing the subject's responses to the questions yielded the following results.

1. All subjects said the exercises stimulated the kind of thinking they did when they were, or supported, the Director of NMP.
2. All subjects said the exercises represented the problems the Director of NMP might face.
3. All subjects said the exercises were representative of the variety of high-level problems the Director of NMP might face.
4. All subjects considered the scenarios in the exercises to be strategic scenarios.

5. Four of the subjects considered the exercises to be challenging.
6. Four of the subjects said if they faced these scenarios in the real-world that at least their initial responses would not be different.

5.3 Analysis of Scenario Data

The scenario data provided to the subjects in the experiment were common to all subjects. The number of relationships and operators in the scenario was small. Therefore, only the entities and the characteristics of the entities in the scenarios was analyzed. For the following analyses, the term "use" means "use of entities" rather than "the frequency of use of entities."

5.3.1 Number of Entities in the Scenarios

Figure 20, *Number of Entities in the Scenarios*, shows the number of entities used in each scenario. There were relatively few entities used in each scenario and the number of entities varied.

5.3.2 Entities Common to More than One Scenario

Figure 21, *Entities Common to More than One Scenario*, shows the commonality of entities between the scenarios. No entity was used in more than two scenarios and only four entities were used in two scenarios.

Number of Entities Used in the Scenarios

Use = Binary Measure

	Scenario					
	1	2	3	4	5	Total
Number of Entities	9	6	6	9	8	38

Number of Entities by Scenario

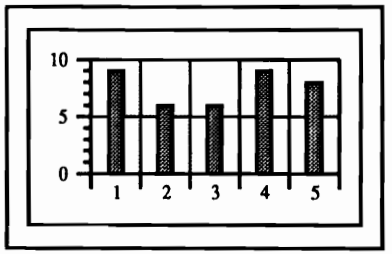


Figure 20. Number of Entities in the Scenarios

Entities Used in 'X' out 5 Scenarios *Use = Binary Measure*

5 out of 5		4 out of 5		3 out of 5		2 out of 5	
Number Found	0	Number Found	0	Number Found	0	Number Found	4
ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION
(No Entities Found)		(No Entities Found)		(No Entities Found)		E18	President Bush
						E23	The Washington Post
						E41	All reactors
						E42	Secretary of Energy

Figure 21. Entities Common to More than One Scenario

5.3.3 Level of Detail of Entities in the Scenarios

Figure 22, *Level of Detail of Entities in the Scenario*, shows the scenario entities by level of detail. In most cases, the rank order of levels was one, two, and then three. Where this was not the case, neighboring levels had equal numbers of entities. For all scenarios together, the rank order was one, two, and three.

5.3.4 Class of Entities Used in the Scenarios

Figure 23, *Class of Entities in the Scenarios*, shows the use of entities in the scenarios by entity class. Not all entity classes were used and Figure 23, *Class of Entities in the Scenarios*, shows only those classes used. In all scenarios, people class entities were used more than or equally as much as entities of any other class.

5.3.5 Internal/External Values of Entities Used in the Scenarios

Figure 24, *Internal/External Values of Entities in the Scenarios*, shows the use of entities in the scenarios by internal/external. In all scenarios, more external entities were used than internal entities or entities that can be considered both internal and external.

5.4 Analysis of Coded Protocol Data

The analyses of the units of information identified in the coded protocols demonstrates the possibilities for examining the data. These analyses are not intended to be an exhaustive set.

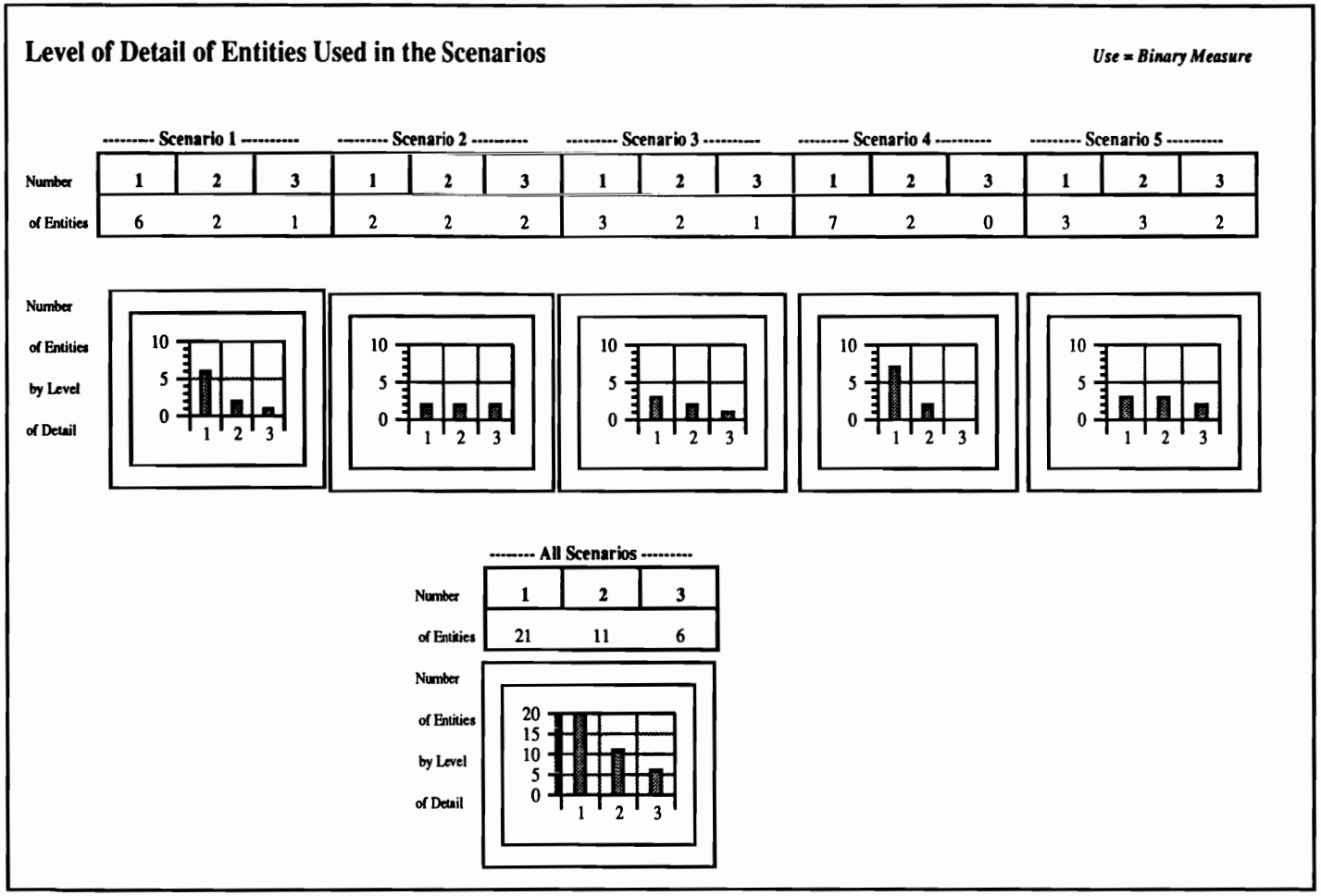


Figure 22. Level of Detail of Entities in the Scenario

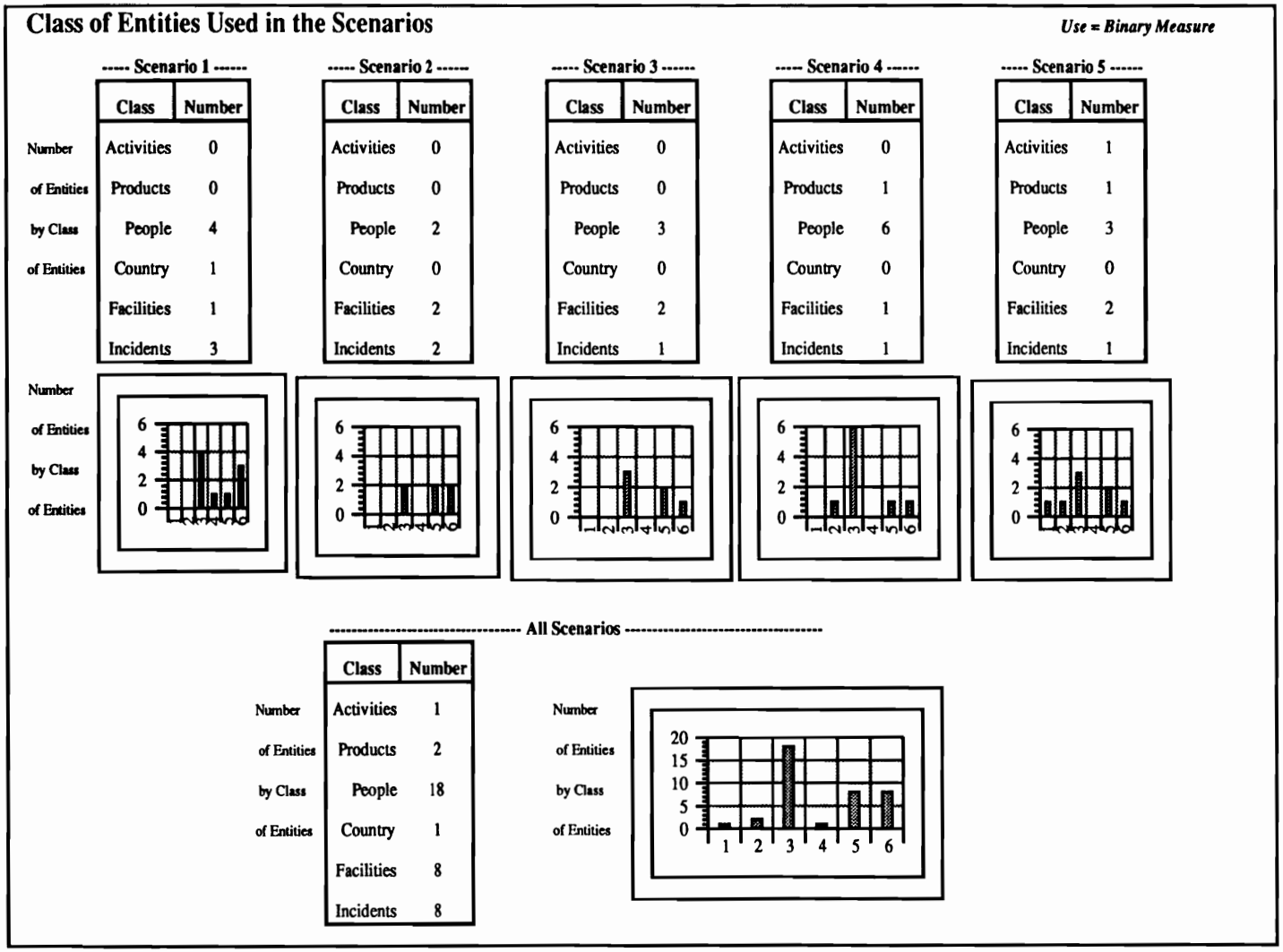


Figure 23. Class of Entities in the Scenarios

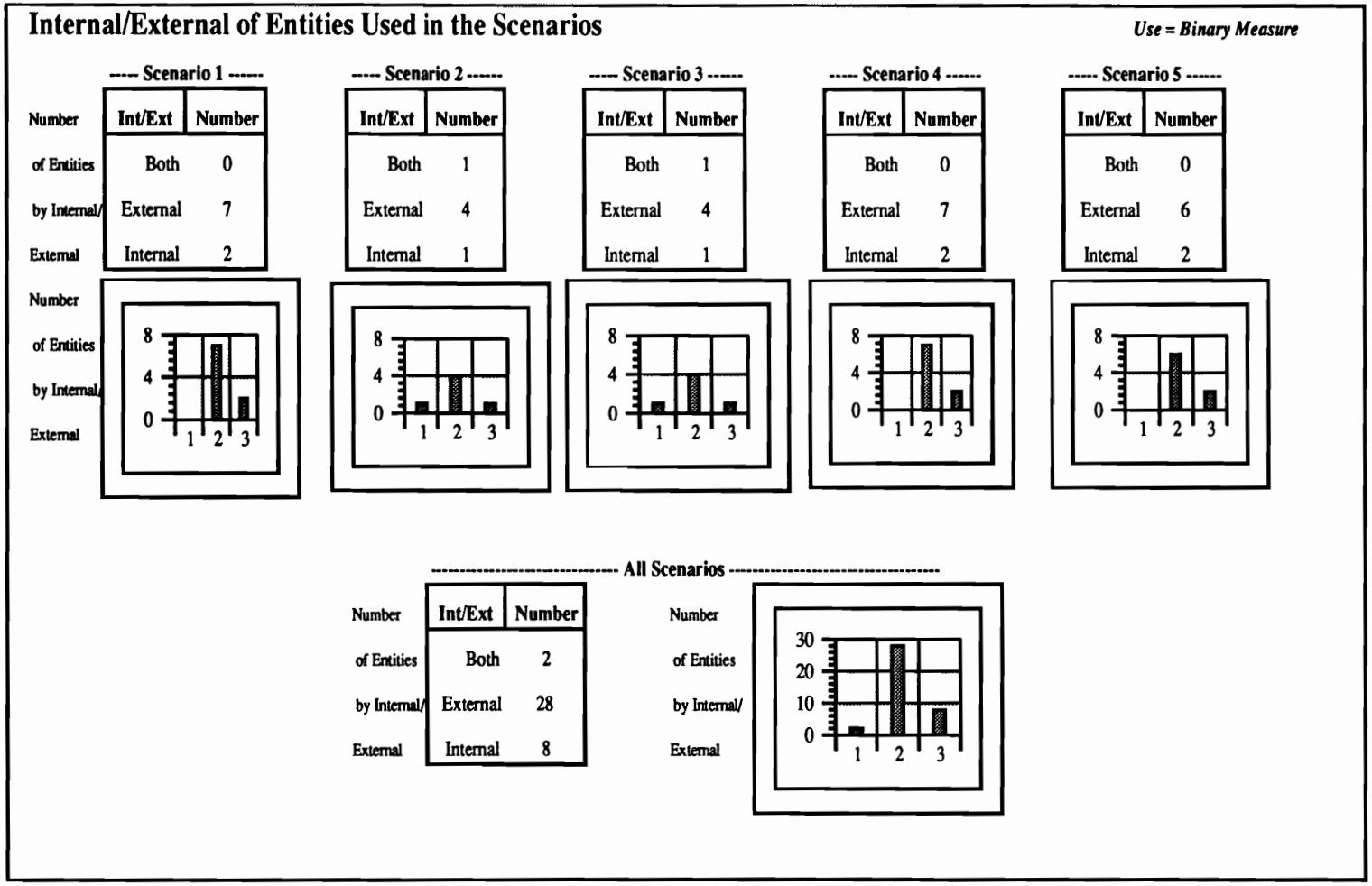


Figure 24. Internal/External Values of Entities in the Scenarios

Two types of usage of a unit of information were calculated. First, use of a unit of information was defined to be the number of times the unit of information was referenced in the exercises and is labeled "frequency of use." Second, use of a unit of information was defined according to a binary scale--either the unit of information was used (use = 1) or the unit of information was not used (use = 0). The second measure of use is labeled "use."

Each set of data analyses involved examining the usage of units of information according to one or more information characteristics. For example, to examine the subjects' use of entities by internal/external characteristics required calculating the total use of entities in each possible value of internal/external by subject and by exercise. The results of these calculations are presented in this section as figures. Each figure typically shows the totals by value of the information characteristic under consideration for each subject and for each exercise. Below the these totals, a graph of these values for each subject by exercise is shown. Then a ratio is typically calculated to examine a particular relationship, e.g., the use of internal entities versus external entities. Ratio's are calculated and graphs generated to more easily identify patterns and exceptions to the patterns.

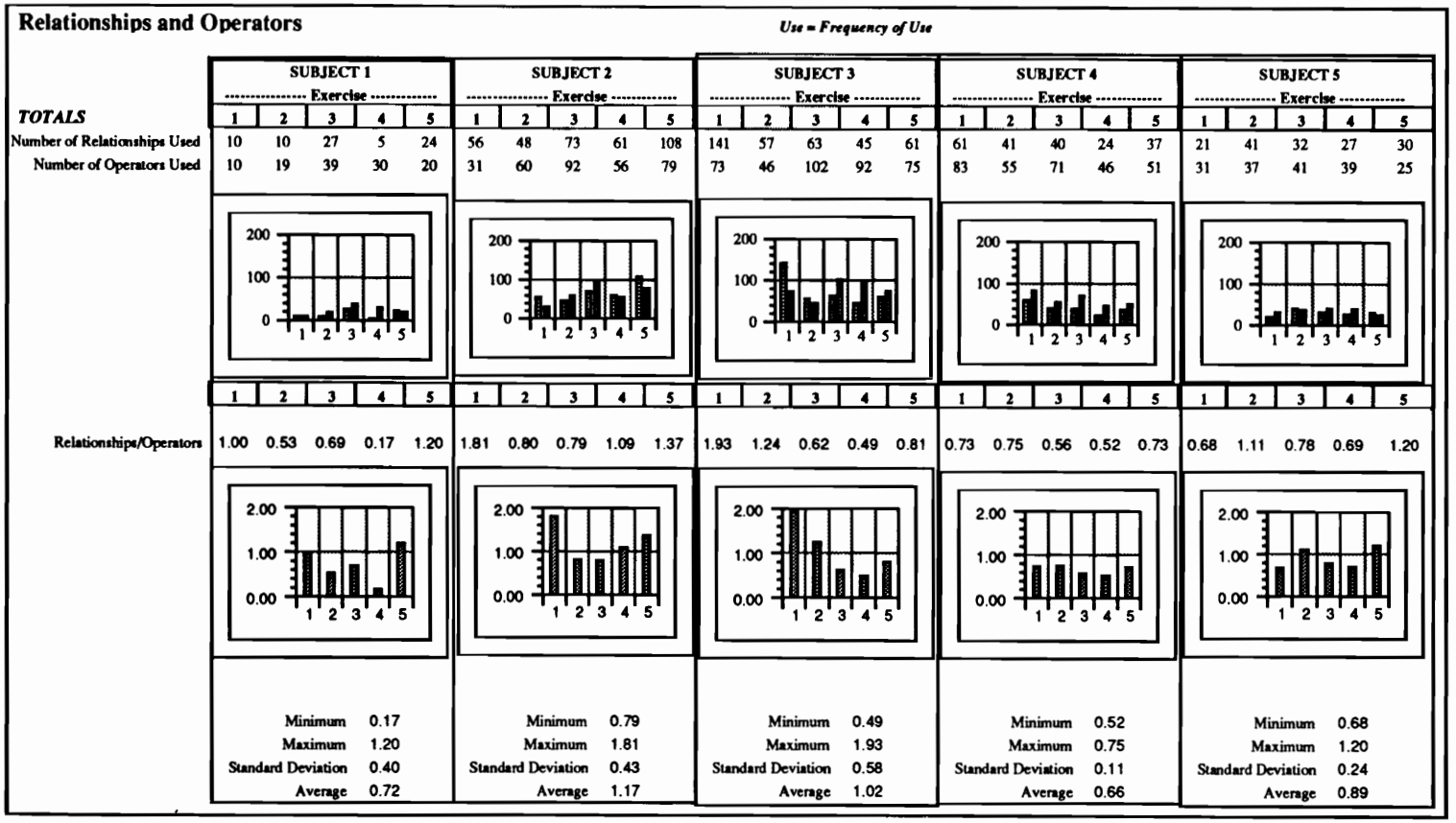
In all data analyses, the entities "Director of NMP" and "Someone" and their usage were excluded. These entities were determined to result from the processes of verbalizing and coding and not a part of the subjects' decision processes or information needs.

5.4.1 Analysis of Types of Information

This analysis of types of information examines the units of information by type to determine if patterns exist. The types of information are entities, relationships, and operators with attributes of each and values of attributes.

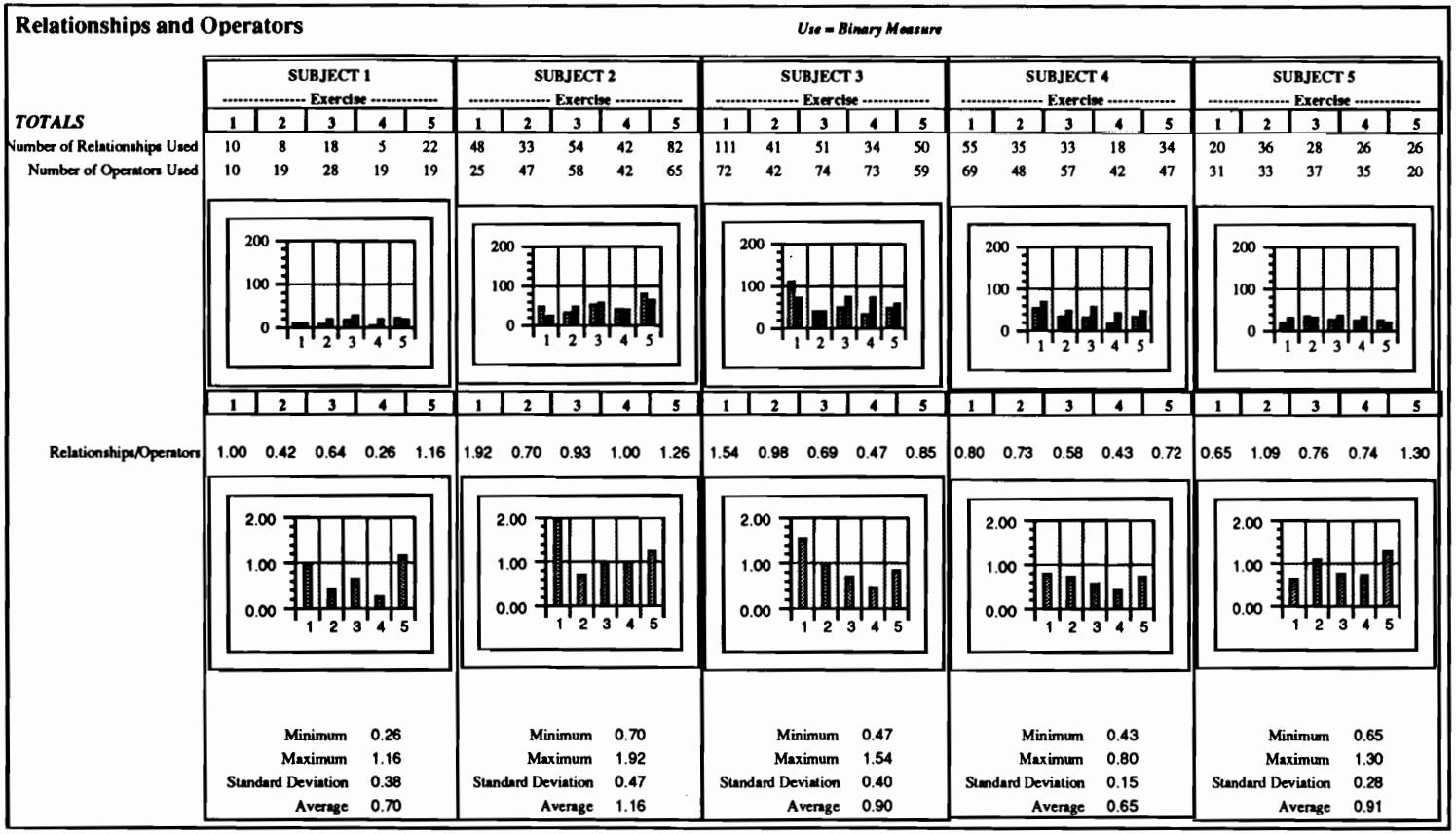
5.4.1.1 Relationships and Operators

Figure 25, *Frequency of Use o Relationships and Operators*, presents the data analysis of the frequency of use for relationships and operators. Figure 26, *Use of Relationships and Operators*, presents the same analysis



TOTALS	SUBJECT 1					SUBJECT 2					SUBJECT 3					SUBJECT 4					SUBJECT 5				
Exercise	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Number of Relationships Used	10	10	27	5	24	56	48	73	61	108	141	57	63	45	61	61	41	40	24	37	21	41	32	27	30
Number of Operators Used	10	19	39	30	20	31	60	92	56	79	73	46	102	92	75	83	55	71	46	51	31	37	41	39	25
Relationships/Operators	1.00	0.53	0.69	0.17	1.20	1.81	0.80	0.79	1.09	1.37	1.93	1.24	0.62	0.49	0.81	0.73	0.75	0.56	0.52	0.73	0.68	1.11	0.78	0.69	1.20
Minimum	0.17					0.79					0.49					0.52					0.68				
Maximum	1.20					1.81					1.93					0.75					1.20				
Standard Deviation	0.40					0.43					0.58					0.11					0.24				
Average	0.72					1.17					1.02					0.66					0.89				

Figure 25. Frequency of Use of Relationships and Operators



TOTALS	SUBJECT 1 Ex 1	SUBJECT 1 Ex 2	SUBJECT 1 Ex 3	SUBJECT 1 Ex 4	SUBJECT 1 Ex 5	SUBJECT 2 Ex 1	SUBJECT 2 Ex 2	SUBJECT 2 Ex 3	SUBJECT 2 Ex 4	SUBJECT 2 Ex 5	SUBJECT 3 Ex 1	SUBJECT 3 Ex 2	SUBJECT 3 Ex 3	SUBJECT 3 Ex 4	SUBJECT 3 Ex 5	SUBJECT 4 Ex 1	SUBJECT 4 Ex 2	SUBJECT 4 Ex 3	SUBJECT 4 Ex 4	SUBJECT 4 Ex 5	SUBJECT 5 Ex 1	SUBJECT 5 Ex 2	SUBJECT 5 Ex 3	SUBJECT 5 Ex 4	SUBJECT 5 Ex 5
Number of Relationships Used	10	8	18	5	22	48	33	54	42	82	111	41	51	34	50	55	35	33	18	34	20	36	28	26	26
Number of Operators Used	10	19	28	19	19	25	47	58	42	65	72	42	74	73	59	69	48	57	42	47	31	33	37	35	20
Relationships/Operators	1.00	0.42	0.64	0.26	1.16	1.92	0.70	0.93	1.00	1.26	1.54	0.98	0.69	0.47	0.85	0.80	0.73	0.58	0.43	0.72	0.65	1.09	0.76	0.74	1.30
Minimum	0.26					0.70					0.47					0.43					0.65				
Maximum	1.16					1.92					1.54					0.80					1.30				
Standard Deviation	0.38					0.47					0.40					0.15					0.28				
Average	0.70					1.16					0.90					0.65					0.91				

Figure 26. Use of Relationships and Operators

of the use of relationships and operators. The following patterns were observed.

The average ratio for each subject differs from subject to subject for both frequency of use and use. In three out of five exercises, each subject referred to either more relationships than operators or visa versa. Therefore, the following empirical generalization is made.

1. The ratio of the number of operators versus the number of relationships the subjects used was found to be consistent for a given subject in three out of five exercises and found to vary from subject to subject.

5.4.1.2 Entities

The data analysis concerning entities focuses on the identification of entities that were used by a subject in more than one exercise. The data analysis is presented in Figures 27, *Common Entities in 4 and 5 out of 5 Exercises*, 28, *Common Entities in 3 out of 5 Exercises*, and 29, *Common Entities in 2 out of 5 Exercises*. The definition of use for the analysis was the binary measure since the concern was simply whether or not the subject used the unit of information in a number of exercises.

Four different criteria for accepting a unit of information as part of a common set of non-scenario entities were employed. When the criterion was the unit of information was used by the subject in all five exercises, only three subjects had entities that met the criterion; and, in each case, only one entity was used in all five exercises. The qualifying entities are generic entities.

When the criterion for acceptance is if the entities are used in three out of five exercises, the lists of entities was more substantial. However, only a few entities appear on more than one subject's list. "Staff" was the only entity that appeared on the list for all five subjects. Therefore, the following empirical generalization is made.

2. A core set of entities was more consistent within subjects.

Common Entities *Use = Binary Measure*

Referenced in all 5 Exercises

Subject 1		Subject 2		Subject 3		Subject 4		Subject 5	
ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION
(No Entities Found)		E54	NMP activities	E130	DOE	E54	NMP activities	(No Entities Found)	

Referenced in at least 4 out of 5 Exercises

Subject 1		Subject 2		Subject 3		Subject 4		Subject 5	
ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION
E54	NMP activities	E54	NMP activities	E186	Incidents	E54	NMP activities	E58	Staff
E58	Staff	E58	Staff	E54	NMP activities	E221	Corrective actions	E17	Current stockpile case
		E83	Supply of nuclear material	E58	Staff			E79	SR
				E130	DOE				

Figure 27. Common Entities in 4 and 5 out of 5 Exercises

Common Entities

Use = Binary Measure

Referenced in at least 3 out of 5 Exercises

Subject 1		Subject 2		Subject 3		Subject 4		Subject 5	
ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION
E54	NMP activities	E4	NMP	E185	Options for dealing with incidents	E4	NMP	E54	NMP activities
E58	Staff	E54	NMP activities	E186	Incidents	E155	Crossover point of all material	E58	Staff
E84	Demand for nuclear material	E58	Staff	E54	NMP activities	E54	NMP activities	E17	Current stockpile case
		E17	Current stockpile case	E58	Staff	E58	Staff	E79	SR
		E79	SR	E87	Something	E79	SR	E87	Something
		E83	Supply of nuclear material	E116	New supply/demand cases	E83	Supply of nuclear material	E202	Nuclear material
		E106	NMP facilities	E130	DOE	E106	NMP facilities		
		E115	Planning Division Director	E134	Problem	E116	New supply/demand cases		
		E116	New supply/demand cases			E117	Current supply/demand cases		
						E221	Corrective actions		
						E224	OMA		

Figure 28. Common Entities in 3 out of 5 Exercises

Common Entities

Use = Binary Measure

Referenced in at least 2 out of 5 Exercises

Subject 1		Subject 2		Subject 3		Subject 4		Subject 5	
ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION	ERO	DESCRIPTION
E54	NMP activities	E4	NMP	E6	SR Reactors	E4	NMP	E4	NMP
E58	Staff	E7	L-reactor	E7	L-reactor	E155	Crossover point of all material	E186	Incidents
E64	Congressional Committees	E8	K-reactor	E9	P-reactor	E54	NMP activities	E54	NMP activities
E84	Demand for nuclear material	E9	P-reactor	E177	DOD	E58	Staff	E58	Staff
E88	Someone other than the Director of NMP	E155	Crossover point of all material	E185	Options for dealing with incidents	E79	SR	E72	Superiors
E89	NMP decision	E160	Recommendations from the env	E186	Incidents	E83	Supply of nuclear material	E17	Current stockpile case
		E54	NMP activities	E54	NMP activities	E84	Demand for nuclear material	E79	SR
		E55	Nuclear material called for in th	E58	Staff	E92	Environmental review	E87	Something
		E58	Staff	E79	SR	E106	NMP facilities	E106	NMP facilities
		E17	Current stockpile case	E83	Supply of nuclear material	E111	Alternative supplies of tritium	E202	Nuclear material
		E79	SR	E84	Demand for nuclear material	E115	Planning Division Director	E262	Other sites
		E83	Supply of nuclear material	E87	Something	E116	New supply/demand cases		
		E84	Demand for nuclear material	E98	SIS	E117	Current supply/demand cases		
		E92	Environmental review	E109	Alternative supplies of plutonium	E221	Corrective actions		
		E106	NMP facilities	E116	New supply/demand cases	E222	Supply of plutonium		
		E115	Planning Division Director	E130	DOE	E224	OMA		
		E116	New supply/demand cases	E134	Problem	E230	DOE Congressional Affairs		
		E117	Current supply/demand cases	E190	Nuclear weapons	E252	Environmental issues		
		E120	Tritium			E190	Nuclear weapons		
		E128	Weapons complex			E198	Support contractors		
						E218	Reactor production of plutonium		

Figure 29. Common Entities in 2 out of 5 Exercises

5.4.2 Analysis of Characteristics of Entities

The following data analyses and proposed empirical generalizations deal with only entities and the information characteristics assigned to entities.

5.4.2.1 Source

The data analysis of the usage of entities by source is shown in Figures 30, *Frequency of Use of Entities by Source*, and 31, *Use of Entities by Source*. The ratio of non-exercise and base entities to scenario entities is greater than 1.0 in all exercises for each subject when use is a binary measure. When use is measured as the frequency of use, there is no consistent pattern. Therefore, the following empirical generalization is made.

3. Subjects used more units of information other than units of information provided in the scenarios.

5.4.2.2 Level of Detail

The data analysis for entities by level of detail is shown in Figures 32, *Frequency of Use of Entities by Level of Detail*, and 33, *Use of Entities by Level of Detail*. In examining both the frequency of use and use, in twenty-four exercise out of twenty-five exercises the ratio of the sum of level 3, 4, and 5 use to the sum of level 1 and 2 use is less than 1.0. Considering the one instance to be an outlier, the following empirical generalization is made. It is also noted that the most detailed level of data used were level 5.

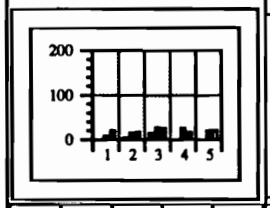
4. Subjects used more level 1 and level 2 entities than other level entities and the greatest level of detailed entities used by subjects was level 5.

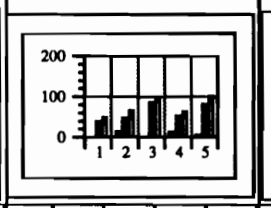
5.4.2.3 Class of Entities

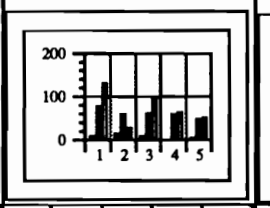
The data analysis for entities by class is shown in Figures 34, *Frequency of Use of Entities by Class*, and 35, *Use of Entities by Class*. Examining the frequency of use data, in all but one exercise, the class of entities most used was either people or facilities. When examining the use data, in all exercises, the class of entities

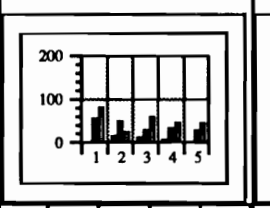
Entities by Source — *Use = Frequency of Use*

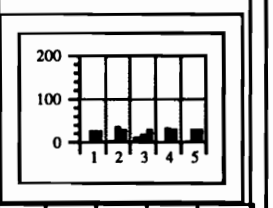
TOTALS	SUBJECT 1 Exercise 1	2	3	4	5	SUBJECT 2 Exercise 1	2	3	4	5	SUBJECT 3 Exercise 1	2	3	4	5	SUBJECT 4 Exercise 1	2	3	4	5	SUBJECT 5 Exercise 1	2	3	4	5
Number of Base	0	4	15	0	0	0	15	0	14	6	9	14	9	0	4	2	15	12	6	2	0	3	11	0	1
Number of Scenario	8	15	27	26	20	40	48	86	53	82	78	60	61	59	48	55	49	28	33	27	25	35	17	32	28
Number of Non-Exercise	20	17	26	17	22	49	66	100	64	101	131	28	94	64	51	81	24	59	45	44	25	28	28	30	28



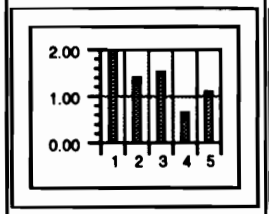


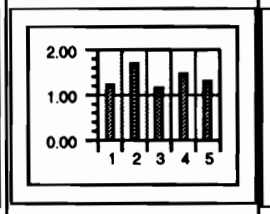


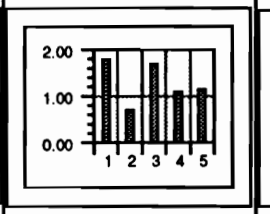


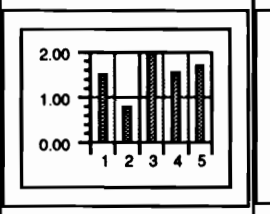


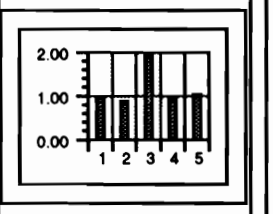
(Non-Exercise + Base) / Scenario	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	2.50	1.40	1.52	0.65	1.10	1.23	1.69	1.16	1.47	1.30	1.79	0.70	1.69	1.08	1.15	1.51	0.80	2.54	1.55	1.70	1.00	0.89	2.29	0.94	1.04











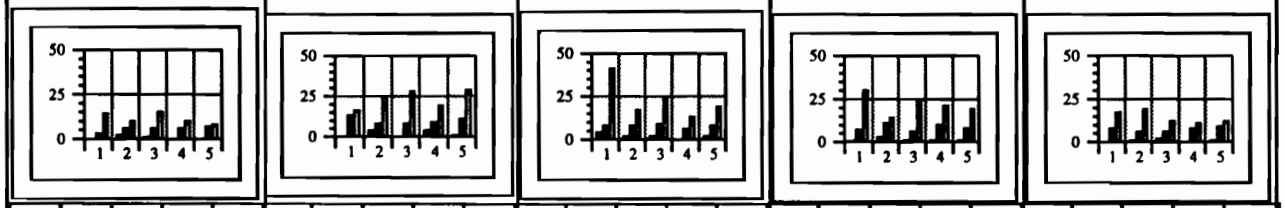
Minimum	0.65	Minimum	1.16	Minimum	0.70
Maximum	2.50	Maximum	1.69	Maximum	1.79
Standard Deviation	0.68	Standard Deviation	0.21	Standard Deviation	0.45
Average	1.43	Average	1.37	Average	1.28

Minimum	0.80	Minimum	0.89		
Maximum	2.54	Maximum	2.29		
Standard Deviation	0.62	Standard Deviation	0.60		
Average	1.62	Average	1.23		

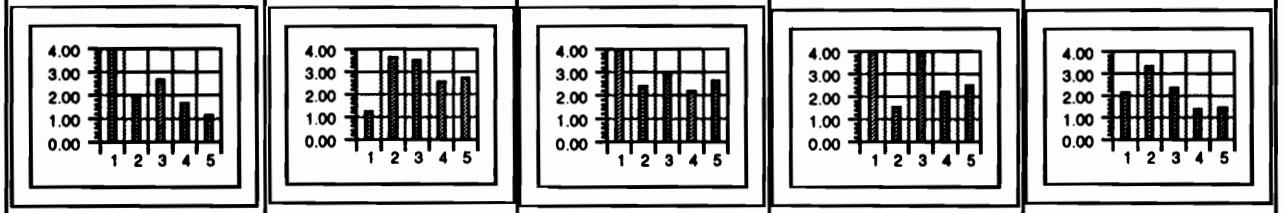
Figure 30. Frequency of Use of Entities by Source

Entities by Source — *Use = Binary Measure*

TOTALS	SUBJECT 1 Exercise 1	2	3	4	5	SUBJECT 2 Exercise 1	2	3	4	5	SUBJECT 3 Exercise 1	2	3	4	5	SUBJECT 4 Exercise 1	2	3	4	5	SUBJECT 5 Exercise 1	2	3	4	5
Number of Base	0	2	1	0	0	0	4	0	4	1	4	2	2	0	2	1	3	1	1	1	0	1	2	0	1
Number of Scenario	3	6	6	6	7	13	8	8	9	11	8	8	9	6	8	7	11	6	10	8	8	6	6	8	9
Number of Non-Exercise	14	10	15	10	8	16	25	28	19	29	41	17	24	13	19	30	14	24	21	19	17	19	12	11	12



	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
(Non-Exercise + Base) / Scenario	4.67	2.00	2.67	1.67	1.14	1.23	3.63	3.50	2.56	2.73	5.63	2.38	2.89	2.17	2.63	4.43	1.55	4.17	2.20	2.50	2.13	3.33	2.33	1.38	1.44

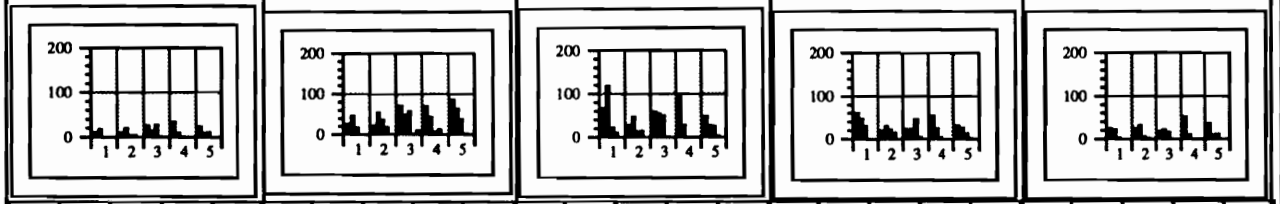


Minimum	1.14		Minimum	1.23		Minimum	2.17		Minimum	1.55		Minimum	1.38	
Maximum	4.67		Maximum	3.63		Maximum	5.63		Maximum	4.43		Maximum	3.33	
Standard Deviation	1.37		Standard Deviation	0.96		Standard Deviation	1.42		Standard Deviation	1.27		Standard Deviation	0.80	
Average	2.43		Average	2.73		Average	3.14		Average	2.97		Average	2.12	

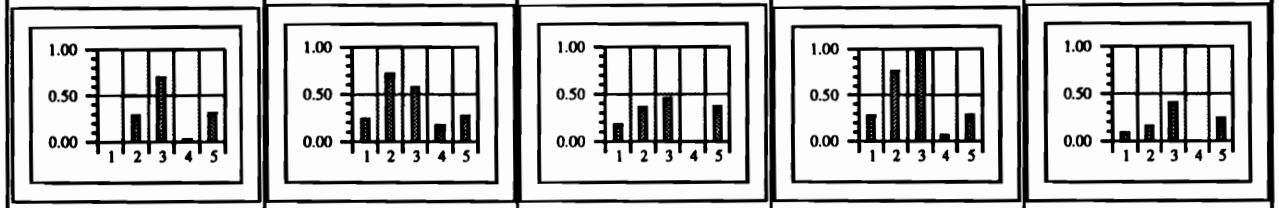
Figure 31. Use of Entities by Source

Entities by Level of Detail — *Use = Frequency of Use*

TOTALS	SUBJECT 1 Exercise 1	2	3	4	5	SUBJECT 2 Exercise 1	2	3	4	5	SUBJECT 3 Exercise 1	2	3	4	5	SUBJECT 4 Exercise 1	2	3	4	5	SUBJECT 5 Exercise 1	2	3	4	5
Level 1	11	9	26	33	23	26	21	70	69	86	67	28	59	96	48	61	20	24	54	31	25	25	18	52	36
Level 2	17	19	14	9	9	46	54	48	43	63	118	47	54	27	27	47	30	24	25	26	21	32	22	10	10
Level 3	0	4	27	1	10	17	36	57	7	37	22	13	50	0	25	30	23	46	5	14	4	6	16	0	11
Level 4	0	4	1	0	0	0	18	1	12	3	11	14	1	0	3	0	15	5	0	2	0	3	0	0	0
Level 5	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Sum(Level 1 & 2)	28	28	40	42	32	72	75	118	112	149	185	75	113	123	75	108	50	48	79	57	46	57	40	62	46
Sum(Level 3, 4, & 5)	0	8	28	1	10	17	54	68	19	40	33	27	51	0	28	30	38	51	5	16	4	9	16	0	11
Ratio (Level 3, 4, & 5) / (Level 1 & 2)	0.00	0.29	0.70	0.02	0.31	0.24	0.72	0.58	0.17	0.27	0.18	0.36	0.45	0.00	0.37	0.28	0.76	1.06	0.06	0.28	0.09	0.16	0.40	0.00	0.24



Minimum	0.00	Minimum	0.17	Minimum	0.00	Minimum	0.06	Minimum	0.00
Maximum	0.70	Maximum	0.72	Maximum	0.45	Maximum	1.06	Maximum	0.40
Standard Deviation	0.28	Standard Deviation	0.24	Standard Deviation	0.18	Standard Deviation	0.41	Standard Deviation	0.15
Average	0.26	Average	0.39	Average	0.27	Average	0.49	Average	0.18

Figure 32. Frequency of Use of Entities by Level of Detail

Entities by Level of Detail — *Use = Binary Measure*

TOTALS	SUBJECT 1 Exercise					SUBJECT 2 Exercise					SUBJECT 3 Exercise					SUBJECT 4 Exercise					SUBJECT 5 Exercise				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Level 1	7	6	11	12	7	9	8	18	18	15	22	13	16	12	13	18	10	9	21	14	14	12	10	14	13
Level 2	10	8	6	3	4	16	17	11	10	15	22	10	11	7	7	12	12	6	9	9	9	11	6	5	6
Level 3	0	2	4	1	4	4	6	5	1	9	4	2	7	0	6	8	3	14	2	3	2	2	4	0	3
Level 4	0	2	1	0	0	0	6	1	3	2	5	2	1	0	3	0	3	2	0	2	0	1	0	0	0
Level 5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Sum(Level 1 & 2)	17	14	17	15	11	25	25	29	28	30	44	23	27	19	20	30	22	15	30	23	23	23	16	19	19
Sum(Level 3, 4, & 5)	0	4	5	1	4	4	12	7	4	11	9	4	8	0	9	8	6	16	2	5	2	3	4	0	3
Ratio (Level 3, 4, & 5) / (Level 1 & 2)	0.00	0.29	0.29	0.07	0.36	0.16	0.48	0.24	0.14	0.37	0.20	0.17	0.30	0.00	0.45	0.27	0.27	1.07	0.07	0.22	0.09	0.13	0.25	0.00	0.16
Minimum	0.00					0.14					0.00					0.07					0.00				
Maximum	0.36					0.48					0.45					1.07					0.25				
Standard Deviation	0.16					0.14					0.17					0.39					0.09				
Average	0.20					0.28					0.22					0.38					0.13				

Figure 33. Use of Entities by Level of Detail

Entities by Class

Use = Frequency of Use

TOTALS	SUBJECT 1 Exercise					SUBJECT 2 Exercise					SUBJECT 3 Exercise					SUBJECT 4 Exercise					SUBJECT 5 Exercise				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Activities	3	2	2	1	18	5	6	14	4	37	22	0	5	5	28	7	5	4	5	15	1	6	1	10	10
Country	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
Decisions	0	0	0	1	1	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	1	0	0	0	0
Environment	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0
Facilities	4	13	29	4	12	33	48	51	34	42	84	70	62	12	32	60	37	24	13	11	15	28	19	3	23
Incidents	7	9	2	5	0	12	14	15	27	13	20	7	10	25	6	18	8	6	16	9	6	12	7	9	2
Information	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
People	8	12	21	31	7	9	33	82	51	53	39	18	73	65	16	40	25	42	39	24	15	12	27	36	17
Products	2	0	3	1	4	23	25	21	13	41	47	3	13	12	20	9	13	20	6	11	2	5	1	4	4
Resources	4	0	2	0	0	5	0	0	0	0	4	0	0	0	1	2	0	0	0	1	2	0	0	0	0
Sites	0	0	8	0	0	0	3	2	1	3	2	4	0	0	0	2	0	3	3	0	7	3	1	0	1
MOST USED	*PEOPLE & FACILITIES					PEOPLE & FACILITIES					PEOPLE & FACILITIES					PEOPLE & FACILITIES					PEOPLE & FACILITIES				

*Not as strong

LEGEND

Most Used

Second

Figure 34. Frequency of Use of Entities by Class

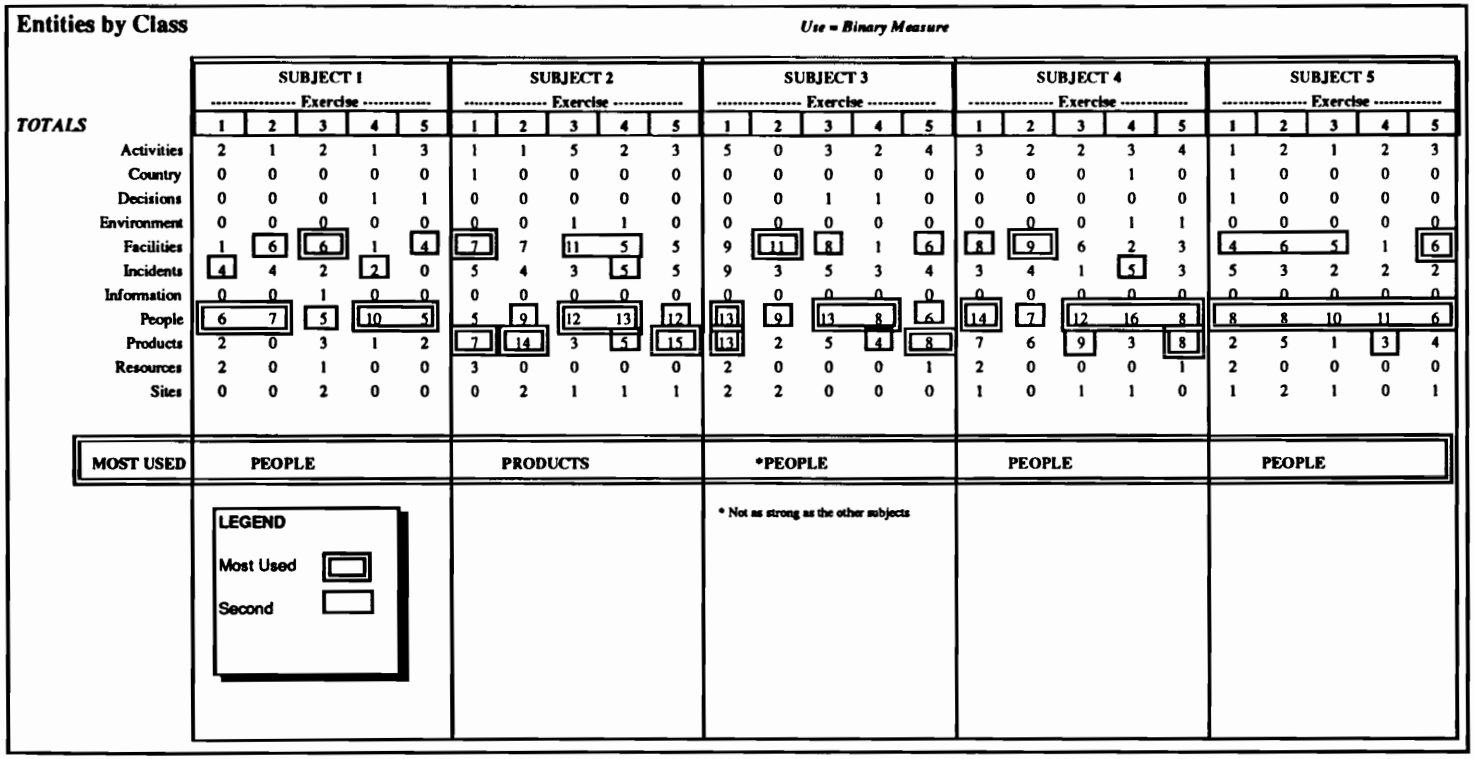


Figure 35. Use of Entities by Class

most used was either people, facilities, or products. Therefore, the following empirical generalization is made employing the use data.

5. Most of the entities subjects used were of the people, facilities, and products classes.

5.4.2.4 Internal/External

The data analysis for entities by internal/external is shown in Figures 36, *Frequency of Use of Entities by Internal/External*, and 37, *Use of Entities by Internal/External*. Examining the data analysis for use shown in Figure 37, *Use of Entities by Internal/External*, in at least three out of five exercises, all subjects use more external entities than internal entities. Examining the data analysis for frequency of use shown in Figure 36, *Frequency of Use of Entities by Internal/External*, in at least three out of five exercises, three out of the five subjects used more internal entities than external entities. Therefore, based on these relaxed criteria, the following empirical generalizations are accepted.

6. Subjects used more external entities than internal entities, but in three out of five subjects, and three out of five exercises, subjects referred to more internal entities than external entities.

5.4.2.5 Level of Detail, Class of Entities, and Internal/External

The data analysis for by level of detail, class, and internal/external is shown in Figures 38, *Frequency of Use of Entities by Level of Detail, Class, and Internal/External*, and 39, *Use of Entities by Level of Detail, Class, and Internal/External*. Based on the data analysis of use shown in Figure 39, *Use of Entities by Level of Detail, Class, and Internal/External*, considering the instances of one entity qualifying as the most-used class as outliers and considering the magnitude of the most-used classes, the following empirical generalization is made.

7. Subjects used more level 4 and level 5 internal and external facilities and internal people classes entities than level 4 and level 5 entities in any other class.

Entities by Internal/External

Use = Frequency of Use

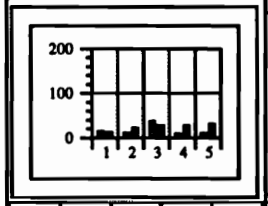
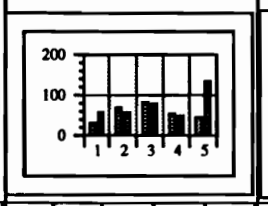
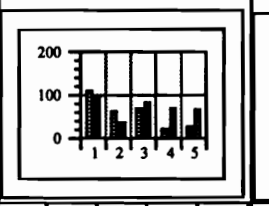
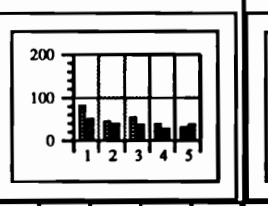
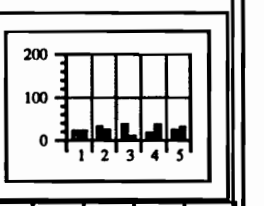
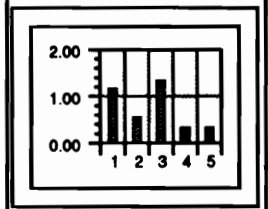
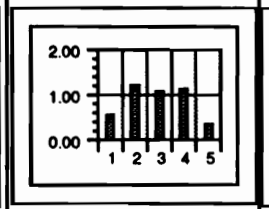
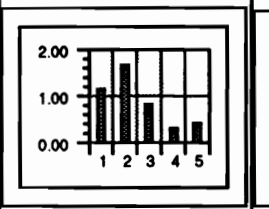
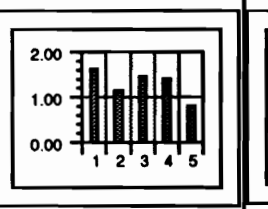
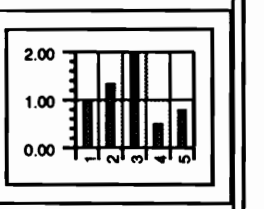
TOTALS		SUBJECT 1 Exercise					SUBJECT 2 Exercise					SUBJECT 3 Exercise					SUBJECT 4 Exercise					SUBJECT 5 Exercise				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	*Both	0	2	3	6	1	1	3	22	27	8	12	3	12	31	8	4	4	8	19	6	4	8	8	7	0
	Internal	15	12	37	9	10	31	69	85	55	46	110	62	69	22	28	83	45	54	38	30	23	33	38	18	25
	External	13	22	28	28	31	57	57	79	49	135	96	37	83	70	67	51	39	37	27	37	23	25	10	37	32
																										
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Internal/External	1.15	0.55	1.32	0.32	0.32	0.54	1.21	1.08	1.12	0.34	1.15	1.68	0.83	0.31	0.42	1.63	1.15	1.46	1.41	0.81	1.00	1.32	3.80	0.49	0.78
																										
	Minimum	0.32					0.34					0.31					0.81					0.49				
	Maximum	1.32					1.21					1.68					1.63					3.80				
	Standard Deviation	0.47					0.39					0.56					0.32					1.33				
	Average	0.73					0.86					0.88					1.29					1.48				

Figure 36. Frequency of Use of Entities by Internal/External

Entities by Internal/External

Use = Binary Measure

TOTALS		SUBJECT 1 Exercise					SUBJECT 2 Exercise					SUBJECT 3 Exercise					SUBJECT 4 Exercise					SUBJECT 5 Exercise				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	*Both	0	2	3	3	1	1	1	7	5	2	5	1	7	5	3	1	2	2	7	4	4	3	3	1	0
	Internal	7	6	9	3	5	13	19	15	13	10	19	13	10	4	9	20	11	16	11	11	5	9	9	5	9
	External	10	10	10	10	9	15	17	14	14	29	29	13	18	10	17	17	15	13	14	13	16	14	8	13	13
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Internal/External	0.70	0.60	0.90	0.30	0.56	0.87	1.12	1.07	0.93	0.34	0.66	1.00	0.56	0.40	0.53	1.18	0.73	1.23	0.79	0.85	0.31	0.64	1.13	0.38	0.69
	Minimum	0.30					0.34					0.40					0.73					0.31				
	Maximum	0.90					1.12					1.00					1.23					1.13				
	Standard Deviation	0.22					0.31					0.23					0.23					0.32				
	Average	0.61					0.87					0.63					0.95					0.63				

Figure 37. Use of Entities by Internal/External

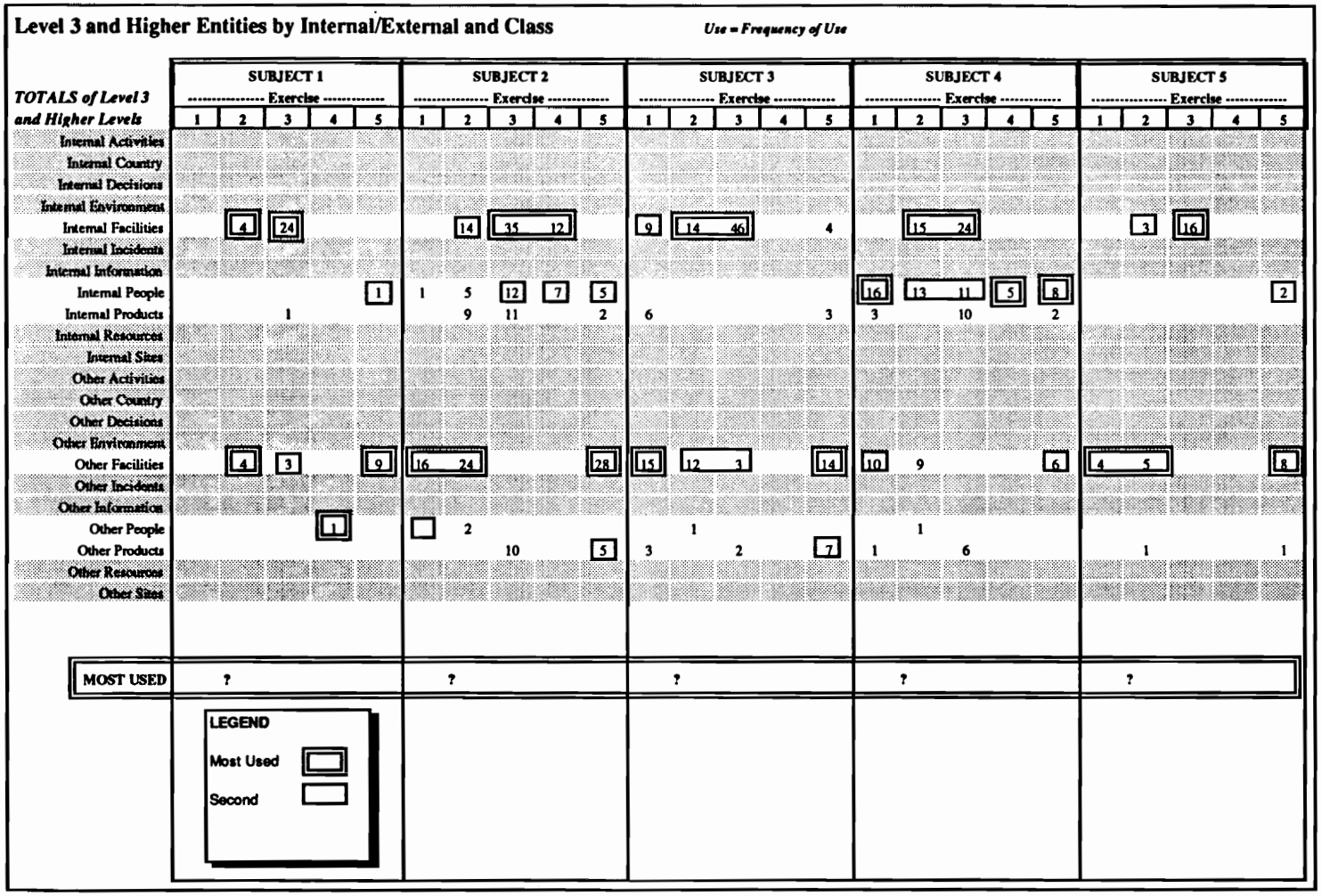


Figure 38. Frequency of Use of Entities by Level of Detail, Class, and Internal/External

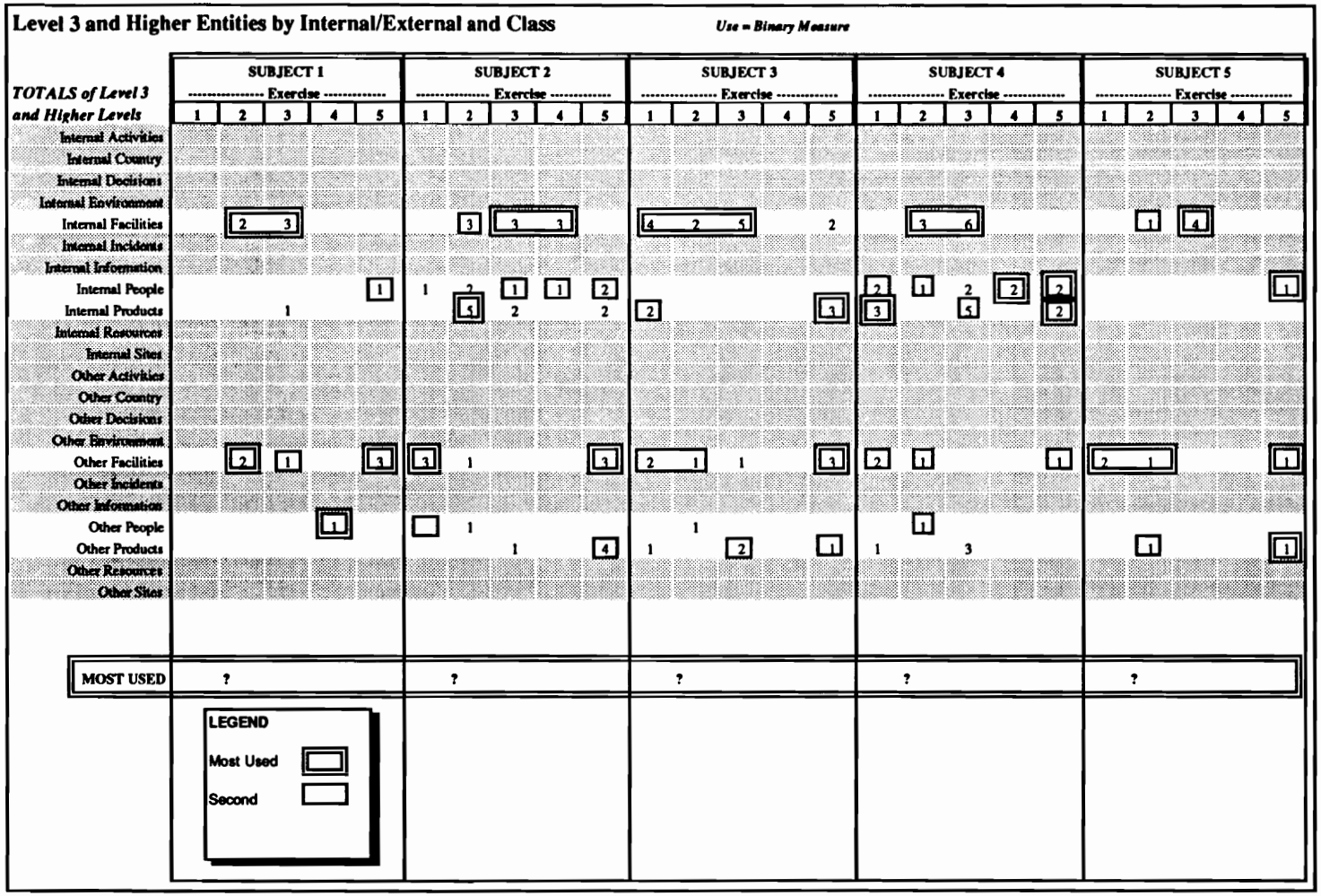


Figure 39. Use of Entities by Level of Detail, Class, and Internal/External

5.4.3 Analysis of Characteristics of Relationships

The following data analyses and empirical generalizations deal with only relationships and the information characteristics assigned to relationships. Since relationships other than those presented in the scenarios were typically used only once by the subjects, the only definition for use employed in the data analyses for relationships was frequency of use.

5.4.3.1 Class of Relationships

The data analysis for relationships by class is shown in Figure 40, *Frequency of Use of Relationships by Class.* The most-used class of relationships in all exercises is the assignment class. Examining the magnitude of the use of assignment class relationships led to calculating the ratio of the use of all other classes of relationships to the use of the assignment class of relationships. In all but two instances, the subjects used more assignment relationships than relationships in all other classes combined. Therefore, the following empirical generalization is made.

8. Subjects used more assignment relationships than any other class of relationships.

5.4.3.2 Internal/External and Class of Relationships

The data analysis for relationships by internal/external and by class is shown in Figure 41, *Frequency of Use of Relationships for Non-Assignment Classes by Internal/External.* In three out of five exercises, in four out of five subjects, the most used internal/external value equals "both." Therefore, the following empirical generalization is made.

9. For three out of five subjects, the subjects used more relationships other than assignment relationships that were both internal and external.

Relationships by Class

Use = Frequency of Use

TOTALS	SUBJECT 1 Exercise 1	2	3	4	5	SUBJECT 2 Exercise 1	2	3	4	5	SUBJECT 3 Exercise 1	2	3	4	5	SUBJECT 4 Exercise 1	2	3	4	5	SUBJECT 5 Exercise 1	2	3	4	5
Assignment	7	6	26	3	20	29	22	57	40	67	95	50	46	38	42	38	24	29	14	21	18	32	27	11	17
Impact	1	2	1	1	4	15	15	11	7	16	15	2	4	4	2	13	10	6	4	8	3	4	0	3	3
Implication	0	0	0	0	0	9	6	0	0	2	6	1	7	2	8	3	2	3	1	1	0	3	2	1	1
Order	1	0	0	1	0	1	0	3	7	8	3	2	0	0	1	2	3	0	0	1	0	1	0	2	1
Ownership	1	2	0	0	0	2	5	2	7	15	22	2	6	1	8	5	2	2	5	6	0	1	3	10	8
MOST USED	ASSIGNMENT					ASSIGNMENT					ASSIGNMENT					ASSIGNMENT					ASSIGNMENT				
Assignment	7	6	26	3	20	29	22	57	40	67	95	50	46	38	42	38	24	29	14	21	18	32	27	11	17
SUM of All Other Classes	3	4	1	2	4	27	26	16	21	41	46	7	17	7	19	23	17	11	10	16	3	9	5	16	13
SUM of Other Classes / Assignment	0.43	0.67	0.04	0.67	0.20	0.93	1.18	0.28	0.53	0.61	0.48	0.14	0.37	0.18	0.45	0.61	0.71	0.38	0.71	0.76	0.17	0.28	0.19	1.45	0.76
	Average Ratio 0.40					Average Ratio 0.71					Average Ratio 0.33					Average Ratio 0.63					Average Ratio 0.57				

LEGEND
Most Used
Second

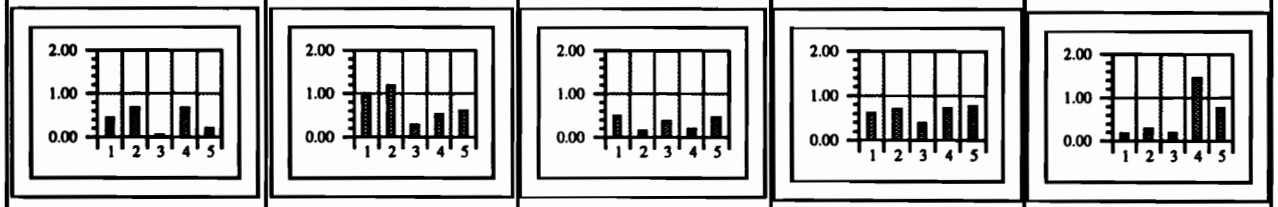


Figure 40. Frequency of Use of Relationships by Class

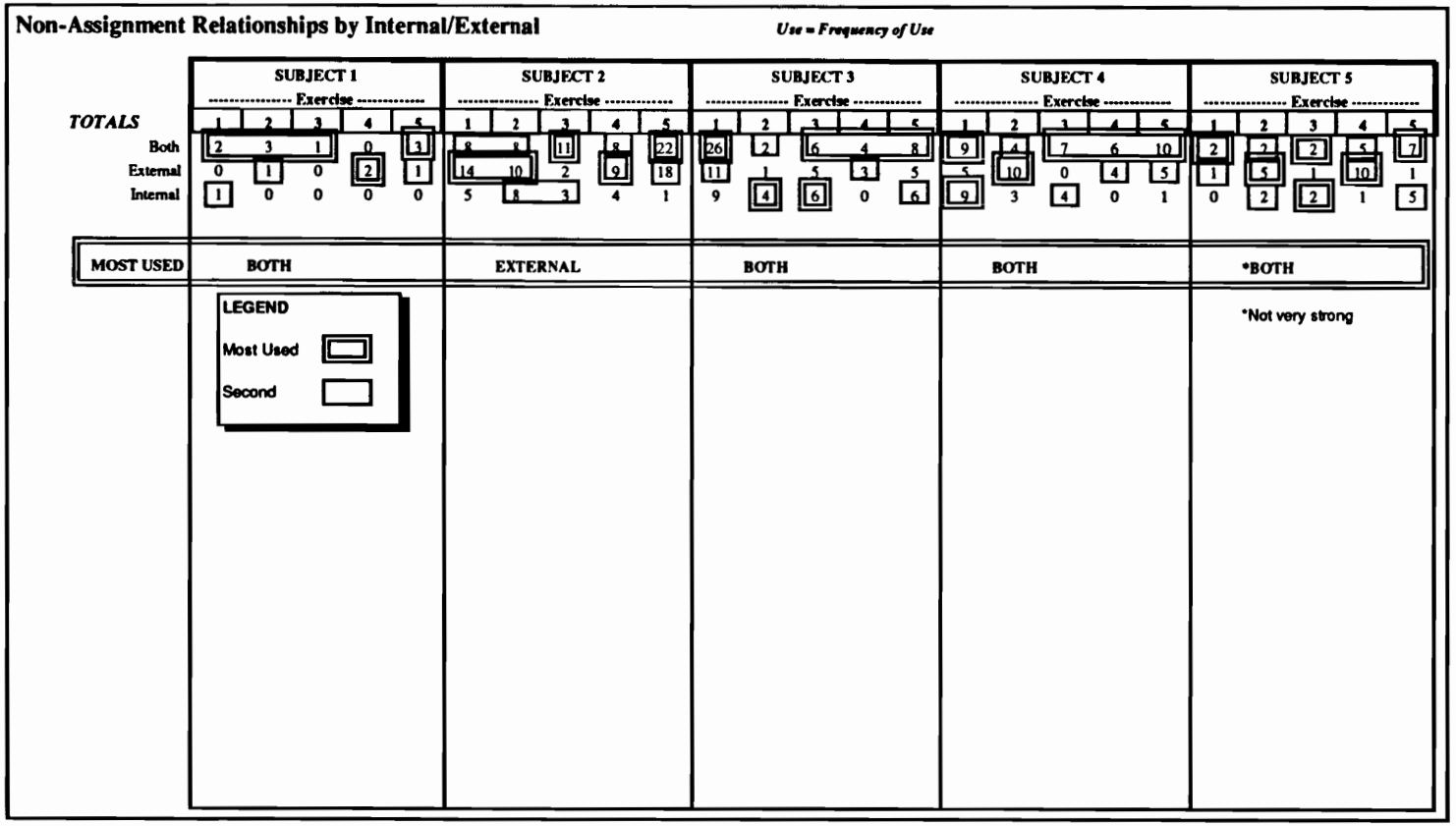


Figure 41. Frequency of Use of Relationships for Non-Assignment Classes by Internal/External

5.4.3.3 Relationship Complexity

The data analysis for relationships by relationship complexity is shown in Figure 42, *Frequency of Use of Relationships by Complexity*. When examining the rank order by relationship complexity, exceptions occur in a maximum of two exercises per subject and typically involve only one relationship. Further analysis showed that the ratio of the sum of references to complexities four, five, and six divided by the sum of references to complexities one, two, and three is less than 1.0 in all exercises for all subjects. Therefore, the following empirical generalization is made.

10. The rank order of relationships by relationship complexity was constant for all subjects and was one, two, three, four, and five.

5.4.4 Analysis of Characteristics of Operators

The following data analysis and empirical generalizations deal with only operators and the information characteristics assigned to operators. Since operators other than those presented in the scenarios were typically used only once by the subjects, the only definition for use employed in the data analyses for operators was frequency of use.

5.4.4.1 Class of Operators

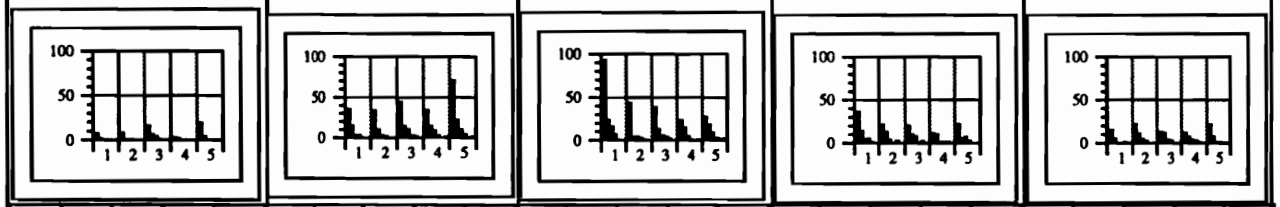
The data analysis for operators by class is shown in Figure 43, *Frequency of Use of Operators by Class*. In four out of five exercises for each subject, the use of the inquires class of operators is greater than the use of informs class of operators. Based on three out of five exercises, the class of operators most used by all subjects is the alters class.

11. Subjects used more alters operators than any other class of operators.
12. Subjects used more inquires operators than informs operators.

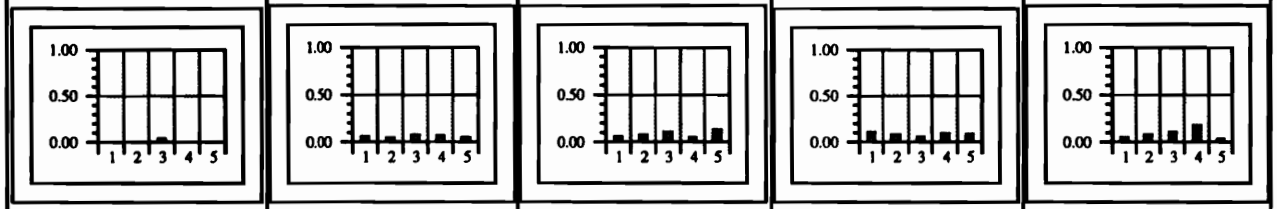
Relationships by Relationship Complexity

Use = Frequency of Use

TOTALS		SUBJECT 1					SUBJECT 2					SUBJECT 3					SUBJECT 4					SUBJECT 5				
		Exercise					Exercise					Exercise					Exercise					Exercise				
RANK ORDER		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	One	7	8	16	3	19	35	33	44	34	71	93	43	38	23	27	36	21	20	11	22	15	22	13	12	21
	Two	2	1	6	2	4	15	10	14	14	22	24	5	13	15	18	14	13	10	10	5	5	11	12	7	7
	Three	1	1	4	0	1	3	3	10	9	10	16	5	6	5	9	5	4	8	1	7	0	5	4	4	1
	Four	0	0	1	0	0	3	2	3	3	4	7	3	4	1	3	5	0	0	1	3	0	3	3	3	1
	Five	0	0	0	0	0	0	0	2	0	0	1	1	2	0	2	1	3	2	1	0	1	0	0	1	0
	Six	0	0	0	0	0	0	0	0	1	1	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0



	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Sum(One, Two, & Three)	10	10	26	5	24	53	46	68	57	103	133	53	57	43	54	55	38	38	22	34	20	38	29	23	29
Sum(Four, Five, & Six)	0	0	1	0	0	3	2	5	4	5	8	4	6	2	7	6	3	2	2	3	1	3	3	4	1
Ratio (Four..Six) / (One..Three)	0.00	0.00	0.04	0.00	0.00	0.06	0.04	0.07	0.07	0.05	0.06	0.08	0.11	0.05	0.13	0.11	0.08	0.05	0.09	0.09	0.05	0.08	0.10	0.17	0.03



Minimum	0.00	Minimum	0.04	Minimum	0.05	Minimum	0.05	Minimum	0.03
Maximum	0.04	Maximum	0.07	Maximum	0.13	Maximum	0.11	Maximum	0.17
Standard Deviation	0.02	Standard Deviation	0.01	Standard Deviation	0.03	Standard Deviation	0.02	Standard Deviation	0.05
Average	0.01	Average	0.06	Average	0.08	Average	0.08	Average	0.09

Figure 42. Frequency of Use of Relationships by Complexity

Operators by Class

Use = Frequency of Use

TOTALS	SUBJECT 1 Exercise 1	2	3	4	5	SUBJECT 2 Exercise 1	2	3	4	5	SUBJECT 3 Exercise 1	2	3	4	5	SUBJECT 4 Exercise 1	2	3	4	5	SUBJECT 5 Exercise 1	2	3	4	5
Alters	0	2	15	17	9	12	17	48	15	24	20	27	41	22	29	22	14	28	24	25	5	12	15	9	7
Believes	0	0	0	0	0	0	0	0	0	2	0	1	3	0	1	0	0	0	0	1	1	0	0	0	2
Communicates	0	0	1	0	0	0	3	1	0	5	2	1	10	6	0	3	1	5	3	3	2	1	6	4	2
Decides	0	1	1	0	0	0	1	3	0	3	6	5	13	6	5	7	2	3	4	6	3	10	0	4	1
Directs	1	2	0	0	0	1	6	0	4	2	0	0	0	1	0	7	6	6	4	4	3	1	3	1	2
Evaluates	0	1	1	0	0	2	0	6	5	8	7	2	7	7	6	14	8	9	4	10	5	2	2	0	6
Informs	3	3	5	5	3	1	0	7	9	0	12	0	7	17	2	11	2	2	4	0	2	0	7	3	0
Inquires	5	6	14	4	8	12	27	24	12	25	19	7	14	17	16	11	7	5	0	2	5	5	2	6	1
Knows	0	0	0	0	0	2	4	3	1	3	2	0	5	1	2	6	9	7	0	0	2	4	5	4	1
Needs	0	0	0	0	0	1	0	0	3	2	2	3	1	12	9	1	0	1	1	0	1	0	1	2	0
Prepares	1	4	2	4	0	0	2	0	5	4	2	0	0	1	5	0	0	3	2	0	1	0	0	2	0
Wants	0	0	0	0	0	0	0	0	2	1	1	0	1	2	0	1	6	2	0	0	1	2	0	4	3
MOST USED	*ALTERS					ALTERS					ALTERS					ALTERS					ALTERS				
Inquires	5	6	14	4	8	12	27	24	12	25	19	7	14	17	16	11	7	5	0	2	5	5	2	6	1
Informs	3	3	5	5	3	1	0	7	9	0	12	0	7	17	2	11	2	2	4	0	2	0	7	3	0
Decides	0	1	1	0	0	0	1	3	0	3	6	5	13	6	5	7	2	3	4	6	3	10	0	4	1
4.1a (1=Inquires>Informs)	1	1	1		1	1	1	1	1	1	1	1	1		1		1	1		1	1	1		1	1
4.1b (1=Informs>Decides)	1	1	1	1	1	1		1	1		1			1		1							1		

*Not as strong

LEGEND

Most Used

Second

Figure 43. Frequency of Use of Operators by Class

5.4.4.2 Relationship Complexity

The data analysis for operators by relationship complexity is shown in Figure 44, *Frequency of Use of Operators by Complexity*. There are only five exceptions which occur in the rank order of operators, mostly in the lower ranks and with only one or two references in magnitude. The only major exception occurs in the fifth exercise of the fourth subject where the subject used seven level-four operators and only three level-three operators. Considering this exercise to be an outlier, the tenth empirical generalization is modified as follows.

10b. The rank order of relationships and operators by relationship complexity was constant for all subjects and was one, two, three, four, and five.

5.4.5 Analysis of Protocols

The following data analysis and empirical generalization deal with the relationship complexity of the protocol itself. The protocol consists of a series of sentences. When coded, each sentence became a single relationship or operator which might include a number of other relationships, operators, entities, attributes, and values. The usage tables for the other data analyses counted the references to units of information within each coded sentence as well as the relationships and operators that represent the sentences. This analysis considered only characteristics of the relationships and operators used to represent the sentences in the protocol. In this regard, the unit of analysis was the protocol sentences used by the subject in an exercise rather than the units of information used by the subject in an exercise.

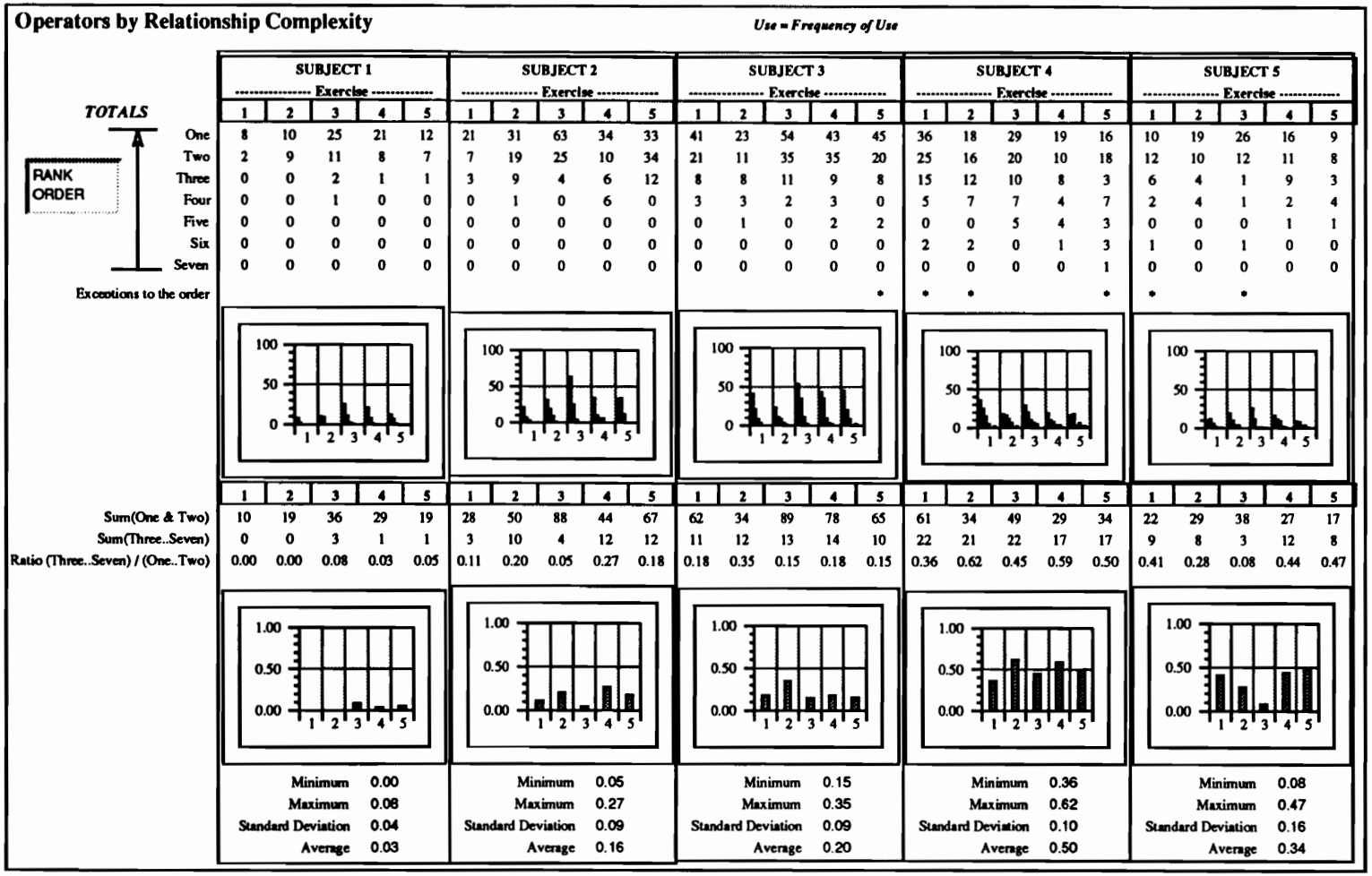


Figure 44. Frequency of Use of Operators by Complexity

5.4.5.1 Protocol Relationship Complexity

The data analysis of the coded protocols by relationship complexity is presented in Figures 45, *Protocol Relationship Complexity by Subject*, 46, *Protocol Relationship Complexity by Subject (Continued)*, and 47, *Protocol Relationship Complexity by Subject (Continued)*. The average relationship complexity for each subject for all exercises differs from subject to subject. Therefore, the following empirical generalization is made.

13. Each subject consistently used the same average relationship complexity in the coded protocol sentences and each subject varied in the average complexity for all sentences for all exercises.

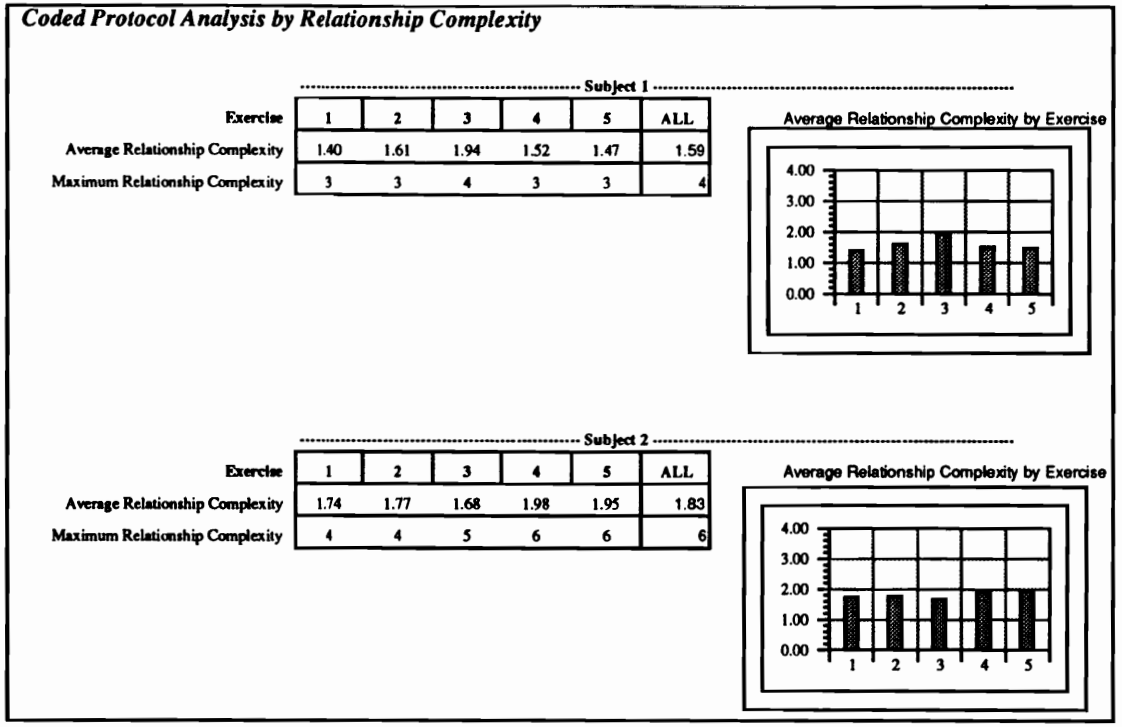
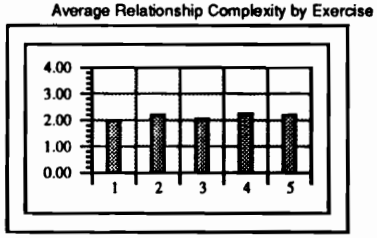


Figure 45. Protocol Relationship Complexity by Subject

Coded Protocol Analysis by Relationship Complexity

Subject 3

Exercise	1	2	3	4	5	ALL
Average Relationship Complexity	1.98	2.19	2.06	2.25	2.19	2.13
Maximum Relationship Complexity	5	5	5	6	6	6



Subject 4

Exercise	1	2	3	4	5	ALL
Average Relationship Complexity	2.72	3.00	2.80	3.04	3.03	2.92
Maximum Relationship Complexity	5	5	5	6	6	6

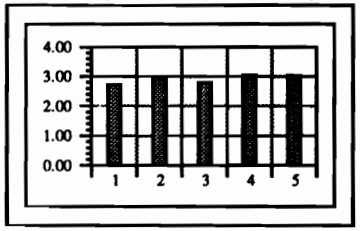


Figure 46. Protocol Relationship Complexity by Subject (Continued)

Coded Protocol Analysis by Relationship Complexity

Subject 5

Exercise	1	2	3	4	5	ALL
Average Relationship Complexity	2.36	2.47	2.21	2.75	2.04	2.37
Maximum Relationship Complexity	5	5	5	6	6	6

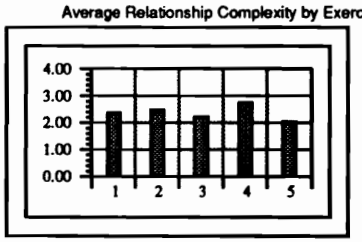


Figure 47. Protocol Relationship Complexity by Subject (Continued)

6.0 ANALYSIS AND IMPLICATIONS

6.1 Specific Analysis

The results presented in Chapter 5.0, *Results and Specific Analyses*, lead to analysis about the sample population of nuclear GOA managers, about the experiment and the methodology employed, about the research concepts upon which the methodology is based, about the information needs of nuclear GOA managers, and about the strategic decision processes. This chapter addresses these points along with relating the research to the archival literature.

6.1.1 Sample Population Analysis

The results from the Entrance Questionnaires led to analysis concerning the sample population of nuclear GOA managers. There was not a sufficient number of managers to draw statistically valid conclusions about nuclear GOA managers in general. Therefore, the following comments should be viewed as summary statements about the subjects participating in this research to provide a description of the sample population for comparison with further research results. The conclusions about the subjects are as follows.

- The subjects have common formal education in a technical discipline and common work experience in nuclear, GOAs;
- The subjects have sufficient experience, at least two years, in the laboratory domain of responsibility to qualify as subjects;
- The subjects have sufficient experience, at least three years, in strategic decision making to qualify as subjects;
- The subjects differ in personality traits which should cause some variance in the information needs; and
- The subjects differ in how they code information in short-term memory which should enable some to more easily perform the exercises.

6.1.2 Experiment and Methodology Analysis

For the purposes of this research, a manager's information needs are defined to be the information the manager uses in the strategic decision processes. Information use is determined in an objective manner by defining information use as the information a manager verbally references during the experiment. Undoubtedly, the manager uses information that is not verbalized. However, defining information use in this manner enables information use to be measured. A manager must express information needs to enable an external source to provide the information. Therefore, exclusion of non-verbalized information, while impacting the researcher's ability to replicate strategic decision processes, does not seriously impact the results in terms of their implications for strategic decision process support.

Part I of the Structured Interview required the subject to reflect upon the exercise and write the information needs. Since in all cases, the information needs identified in Part I were included in the verbalizations and hence, in the coded protocols, the following conclusion is made.

- The coded protocols adequately represent the information needs of the subjects.

Therefore it can be argued that the exercises, the subject's verbalizations, and the subsequent coded protocols are a satisfactory method to collect information about what information a manager needs.

This conclusion is supported in general by the empirical evidence and conclusions of Ericsson and Simon (1980). Their work on the study of verbal protocols as a methodology concluded that verbal protocols best represent the thought processes when they are collected concurrently with the task or shortly after completion of the task. The methodology employed in this research utilized both concurrent verbalization and retrospective verbalization immediately after task completion. The restrospective verbalization, Part I of the structured interview, was used to validate the concurrent verbalization.

The results from the subjects' responses to the Exit Questionnaire lead to the following conclusions.

- The problems represented by the scenarios were believed to be strategic problems.
- The problems represented by the scenarios were realistic.
- The problems represented by the scenarios were varied.

- The subjects viewed the exercises as a worth-while use of their time.
- The results obtained from the analyses of the verbalizations converted to coded protocols is valid in representing the subject's initial responses to strategic scenarios in the real-world.

The Elementary Mental Activities Model is proposed to represent the entire, strategic decision process from the manager observing a unit of information and perceiving the existence of a strategic problem to the final decisions on managerial actions to mediate or resolve the strategic problem. The methodology was designed based on the Elementary Mental Activities Model. However, the nature of the exercises employed in the methodology created a limiting factor on the subject's ability to arrive at final decisions regarding the strategic problem. From the responses in the Exit Questionnaire to the question regarding whether or not the manager's responses were realistic, the implication arises that in the real world, the manager would obtain the information needed to arrive at final decisions. During the exercise, the information the subject requested was not provided. The reasons for not providing additional information during the exercise was to ensure that all subjects received the same information. The negative impact of this choice in the experiment was the limiting factor of the subjects not being able to arrive at a final decision. The positive impact of this decision was an enhanced ability in performing between-subject comparisons. Further discussion of the positives and negatives of this choice are presented in Section 6.3, *Summary Implications for the Research Concepts and Methodology*, and in Chapter 7.0, *Summary, Conclusions, and Recommendations*, in Section 7.3, *Recommendations for Further Research.*

The exercises were designed to be strategic exercises according to the arguments presented in Section 4.6, *Strategic Problems*, which were based principally on the research of Mintzberg (1975), Mason and Mitroff (1981), and Ramaprasad and Mitroff (1984). In summary, to be strategic, (a) the exercises represented changes in the environment of the domain that would lead the subject to consider the operating strategies of the domain of responsibility and (b) the information presented to the subject was a series of units of information which may or may not represent one or more problems.

The analysis of the scenario data showed that the scenarios represented changes in the external environment and the scenarios varied in a number of characteristics which implies the potential for different problems to be perceived. This analysis supports the conclusions from the analyses of the Exit Questionnaire that the subjects perceived the scenarios represented varied, strategic problems.

6.1.3 Information Needs Analysis

The results of the analyses of coded protocol data are presented in Chapter 5.0, *Results and Specific Analyses*, in the form of accepted empirical generalizations. A summary of these results and the associated conclusions are shown in Table 5, *Empirical Generalizations and Managerial Conclusions*. The conclusions are labeled managerial conclusions. Whereas the conclusions are stated in broad, managerial terms, the conclusions, at this point, should be considered to apply only to the sample population studied.

Table 6, *Managerial Conclusions and Supporting Literature*, shows the managerial conclusions related to the literature on strategic decision making which supports each conclusion. The only managerial conclusion not supported in the literature is that managers use more information about people, facilities, and products than financial information. This would seem to be a conclusion applicable, for now, only to the subjects participating in this research. Further research is needed to determine if this conclusion applies to all nuclear GOA managers, to all government managers, and/or all managers.

6.1.4 Strategic Decision Processes Analysis

Part III of the Structured Interview required the subjects to describe the final decisions they made. In all cases, the subject's final decision was to collect additional information about the situation represented in the scenario. This leads to the following conclusion.

- No conclusions can be formed based on the nature of the final decisions from the exercises as to whether or not the decision making processes were strategic.

But, because of the following three points:

1. All but one of the managerial conclusions resulting from the analyses of protocol data are supported by the literature as being characteristic of strategic decision making,
2. The scenarios represent strategic problems, and
3. The subjects have at least three years experience in strategic decision making and were able to describe strategic decisions they had made or helped make,

Table 5. Empirical Generalizations and Managerial Conclusions

EMPIRICAL GENERALIZATIONS	MANAGERIAL CONCLUSIONS
The ratio of the number of operators versus the number of relationships the subjects used was found to be consistent for a given subject in three out of five exercises and found to vary from subject to subject.	The amount of information a manager uses determining the situation versus acting on the situation is consistent for the manager for all strategic decision situations but varies from manager to manager.
A core set of entities was more consistent within subjects.	When faced with strategic problems, managers tend to have an individual focus of concern--a way of determining the impact of the incident(s) on their domain of responsibility. This set of entities varies from manager to manager.
Subjects used more units of information other than units of information provided in the scenarios.	Information representing strategic problems triggers the manager to consider a great deal more information.
Subjects used more level 1 and level 2 entities than other level entities and the greatest level of detailed entities used by subjects was level 5.	Managers use top-level information and rarely use detailed information in strategic problem formulation.
Most of the entities subjects used were of the people, facilities, and products classes.	Managers use relatively more information about people, facilities, and products than financial information in nuclear GOAs.
Subjects used more external entities than internal entities, but in three out of five subjects, and three out of five exercises, subjects referred to more internal entities than external entities.	The manager's process involves as much internal information as external but the manager uses information about more external entities.
Subjects used more level 4 and level 5 internal and external facilities and internal people classes entities than level 4 and level 5 entities in any other class.	The detailed considerations of the manager are about the facilities and people within the domain of responsibility and about the facilities outside the domain that have an impact on the manager's facilities and people.
Subjects used more assignment relationships than any other class of relationships.	Managers use more information about the values or relative values of entities, relationships, and operators than assessing impacts and implications.
For three out of five subjects, the subjects used more relationships other than assignment relationships that were both internal and external.	The majority of the manager's information concerns the impacts, implications, and order between or among entities, relationships, or operators that involve both internal and external entities, i.e., the manager is trying to determine the relationship between the managers domain and the domain environment.
The rank order of relationships and operators by relationship complexity was constant for all subjects and was one, two, three, four, and five.	Managers use more simple relationships and operators than complex relationships and operators.
Subjects used more alters operators than any other class of operators.	Managers consider more actions to alter the situation than any other actions, which implies the manager is trying to balance the domain with the domain environment, mediate the impact of the environment on the domain, or return the domain and environment to the status quo.
Subjects used more inquires operators than informs operators.	The net flow of information is in to the manager.
Each subject consistently used the same average relationship complexity in the coded protocol sentences and each subject varied in the average complexity for all sentences for all exercises.	Managers have a certain level of relationship complexity that they either are satisfied with, comfortable with, or capable of dealing with in strategic decision making.

Table 6. Managerial Conclusions and Supporting Literature

MANAGERIAL CONCLUSIONS	SUPPORTING LITERATURE
The amount of information a manager uses determining the situation versus acting on the situation is consistent for the manager for all strategic decision situations but varies from manager to manager.	In general, this conclusion is supported by the work of Ramaprasad and Mitroff (1984) based on the learning theories of Piaget (1974) and linking the logico-mathematical structures with personality traits.
When faced with strategic problems, managers tend to have an individual focus of concern--a way of determining the impact of the incident(s) on their domain of responsibility. This set of entities varies from manager to manager.	Ramaprasad and Mitroff (1984) propose managers utilize previously developed logico-mathematical-structures in formulating strategic problems which would result in the manager using the same entities for most strategic problems.
Information representing strategic problems triggers the manager to consider a great deal more information.	Mintzberg (1973) draws the same conclusion with a different population
Managers use top-level information and rarely use detailed information in strategic problem formulation.	Gorry and Scott Morton (1986) draw this conclusion about the information used in strategic decision making.
Managers use relatively more information about people, facilities, and products than financial information in nuclear GOAs.	In general, this conclusion is supported by the work of Treacy (1986) as part of the identification of the cube of information needs. However, the specific conclusion of emphasis is not supported in the literature surveyed.
The manager's process involves as much internal information as external but the manager uses information about more external entities.	The combined works of Gorry and Scott Morton (1986) and Mintzberg (1978) support this conclusion. Gorry and Scott Morton indicate strategic decision making requires more external information. Mintzberg concludes the role of the strategic manager is balancing the domain with the external environment.
The detailed considerations of the manager are about the facilities and people within the domain of responsibility and about the facilities outside the domain that have an impact on the manager's facilities and people.	This conclusion is also supported by Mintzberg's (1978) conclusion that the role of the strategic manager is balancing the domain with the external environment.
Managers use more information about the values or relative values of entities, relationships, and operators than assessing impacts and implications.	Generally supported by the informational roles identified by Mintzberg (1973).
The majority of the manager's information concerns the impacts, implications, and order between or among entities, relationships, or operators that involve both internal and external entities, i.e., the manager is trying to determine the relationship between the managers domain and the domain environment.	This conclusion is supported by Mintzberg's (1978) conclusion that the role of the strategic manager is balancing the domain with the external environment.
Managers use more simple relationships and operators than complex relationships and operators.	Ramaprasad and Mitroff (1984) support this conclusion in their progression of logico-mathematical structures from simply to more complex.
Managers consider more actions to alter the situation than any other actions, which implies the manager is trying to balance the domain with the domain environment, mediate the impact of the environment on the domain, or return the domain and environment to the status quo.	This conclusion is supported by Mintzberg's (1978) conclusion that the role of the strategic manager is balancing the domain with the external environment. Pounds' (1969) definition and use of operators also supports this conclusion.
The net flow of information is in to the manager.	Mintzberg's (1975) descriptions of the manager's information database supports this conclusion.
Managers have a certain level of relationship complexity that they either are satisfied with, comfortable with, or capable of dealing with in strategic decision making.	In general, this conclusion is supported by the work of Ramaprasad and Mitroff (1984) based on the learning theories of Piaget (1974) and linking the logico-mathematical structures with personality traits.

the following conclusion is made.

- The decision processes the subjects used in the exercises were strategic decision processes.

6.2 General Analysis

The analyses presented in the previous section, when coupled with assumptions about the applicability of the results to a more general population and decision situation, lead to general analyses and conclusions. The assumptions of generalization are presented first. Then the general managerial conclusions and the general conclusions about this research are presented.

6.2.1 Assumptions of Generalization

- The results and conclusions are assumed to generally represent the population of nuclear GOA managers who have at least two years of experience with the nuclear GOA and at least three years experience in strategic decision making, with the exception of political appointees in nuclear GOA management positions.

This assumption is based on the following assumptions and conclusions.

1. The managerial conclusions, though based on a small number of seemingly homogeneous subjects, are supported by research using a wide variety of populations which, by itself, would enable generalizing the results to the general population of managers making strategic decisions.

2. However, the relatively minor use of financial information which was not supported in the literature on strategic decision making is assumed to be a characteristic of nuclear GOA managers strategic decision making processes.

   In all instances in the literature reviewed, when the characteristics of information needed to support strategic decision making was mentioned, financial information was used, if not solely, at least in part. Financial information is used in the literature describing the strategic decision processes, especially in the stages of evaluation and choice, e.g., Mintzberg, et al. (1976). Financial information is the principal information used in strategic content research, e.g., Fahey and Christensen (1986). In the literature concerning providing information to support strategic decision processes, the fundamental element of data is almost exclusively financial data, e.g., Keen and Wagner (1979). No studies were found to substantiate the need for financial information as compared to other classes of information. However, the overwhelming amount of research involving strategic decision making processes and financial information led to the assumption that the manager's use of financial information should be equal to or greater than the use of any other type of information. Since this assumption is not supported in the data analysis, the conclusion was made that the relatively minor use of financial information is a characteristic of the population.

3. In addition, the high degree of commonality in formal, technical education and work experience is assumed to be a characteristic of high-level, nuclear GOA managers who are career managers as opposed to those managers who are political appointees in nuclear GOA management positions and as opposed to high-level managers in other government organizations.

- The results and conclusions are assumed to generally represent nuclear GOA managers engaged in the initial stages of strategic decision making processes.

This assumption is based on the following assumptions and conclusions.

1. A specific conclusion of the research is that the decision processes used by the subjects were strategic.
2. A specific conclusion of the research is that the exercises realistically represent the initial stages of the subjects' strategic decision processes.

3. A specific conclusion of the research is that the scenarios used were representative of the strategic problems facing the particular nuclear GOA chosen as the laboratory domain of responsibility.
4. The laboratory domain of responsibility is assumed representative of all nuclear GOAs.

6.2.2 General Management Conclusions and Implications

Based on the assumptions for generalization presented in the previous section, the following general management conclusions are assumed valid for nuclear GOA managers engaged in the initial stages of strategic decision processes. The conclusions have implications for the Elementary Mental Activities Model and the associated methodology, as well as implications for the design and development of supporting systems for strategic decision processes.

1. Managers have individual approaches to strategic problems which can, in part, be characterized by
   - the amount of time they spend understanding the situation versus the time spent considering managerial actions,
   - the entities of concern to the manager in most strategic decision situations, and
   - the complexity of the relationships and operators they employ in the strategic decision process.

   The implications for strategic decision support are:
   - support systems should be tailored for managers to be more effective,
   - the capability of the support system to support higher order relationships will vary in importance from manager to manager, and
   - a support system which provides the needed information for one manager will probably not be completely sufficient for a different manager since they will tend to rely on different sets of information.

   The implications for the Elementary Mental Activities Model and the associated methodology are:
   - characterizing a manager's information needs, at least in part, characterizes the manager's strategic decision processes which means the methodology is not only useful for determining

information needs, but for strategic process research, and

- the basic premise of the model development that the manager's strategic decision processes can be represented by an information processing system such as the Elementary Mental Activities Model is supported by the discovery of patterns of information consistent for a subject yet varying between subjects.

2. Units of information presented to the manager trigger the need for and use of more information that can be characterized as:
   - top-level,
   - status information, and
   - more external information than internal information.

   The implications for strategic decision support are:
   - it is possible to predetermine, to some degree, the information needed to support a manager's strategic decision processes and to collect, store, and manipulate the information so that it is available when needed, because the majority of the information needs are about entities other than those representing the incident, and
   - the focus of supporting systems should be on top-level, status information about both internal and external entities.

   The implications for the Elementary Mental Activities Model and the associated methodology are:
   - since the characteristics of the scenario information triggering the manager's use of top-level, status information about both internal and external entities are common conclusions in the literature on strategic decision making, the proposition that the Elementary Mental Activities Model is a contextual model for strategic decision processes appears to be supported, and
   - the exercises appear to have stimulated, to some degree, strategic decision processes.

3. Managers focus as much or more of their decision processes on dealing with internal information as external information, but use more information about external entities.

   The implications for strategic decision support are:

- half or more of the information maintained in the support system should be about entities external to the manager's domain of responsibility, and
- it is equally important to maintain and provide information about the manager's domain of responsibility as it is to provide information about entities external to the manager's domain of responsibility.

As for the previous conclusion, the implications for the Elementary Mental Activities Model and the associated methodology are:

- since the characteristics of the need for greater amounts of information about external entities is a common conclusion in the literature on strategic decision making, the proposition that the Elementary Mental Activities Model is a contextual model for strategic decision processes appears to be supported, and
- the exercises appear to have stimulated, to some degree, strategic decision processes.

4. Managers are more concerned with people, facilities, and products than with finances in all levels of detail and in the most detailed levels of information.

The implications for strategic decision support are:

- the emphasis on the information maintained in the support system should be on people, facilities, and products over financial, and
- the support system should be able to relate people, facilities, and products in terms other than financial.

The implication for the Elementary Mental Activities Model and the associated methodology is:

- since (a) this conclusion is not supported in the literature on strategic decision processes, (b) since the Elementary Mental Activities Model is based on the literature on strategic decision processes, and (c) the literature on strategic decision processes emphasizes the need for financial information, the implication is that the Elementary Mental Activities Model and the methodology are descriptive and not biased towards any particular strategic decision process and related information characteristics.

5. Managers attempt to re-balance their domain of responsibility with the domain environment by
   - determining the current situation that exists between their domain of responsibility and the domain environment, and
   - determining ways to alter the situation.

   The implications for strategic decision support are:
   - the supporting systems must be capable of describing and predicting the relationships between internal and external entities, and
   - must be capable of supporting the determination of the impact of proposed managerial actions on the relationships between internal and external entities.

   The implications for the Elementary Mental Activities Model and the associated methodology are:
   - since the characteristics of managers attempting to re-balance their domain of responsibility with the domain environment is a common conclusions in the literature on strategic decision making, the proposition that the Elementary Mental Activities Model is a contextual model for strategic decision processes appears to be supported, and
   - separating operators from other kinds of relationships in the Elementary Mental Activities Model appears to have value in describing the manager's strategic decision processes.

6.3 Summary Implications for the Research Concepts and the Methodology

In summary, the results of the analyses of the data generated in the experiment feed back the following implications about the research concepts, principally the Elementary Mental Activities Model, and the methodology employed based on the research concepts:

1. The methodology is useful for determining information needs of managers engaged in strategic decision processes,
2. The methodology is useful for characterizing, in part, the strategic decision processes of managers,
3. The exercises in the methodology stimulated, to some degree, the subjects to engage in strategic decision processes,

4. The fact that the patterns in information characteristics resulting from the data analyses are supported by the general literature on strategic decision making implies the research concepts and the methodology are sound,
5. The fact that some patterns in information characteristics from the data analyses are not supported in the general literature and appears to be the reflection of a nuclear, GOA characteristic in the strategic decision processes implies the research concepts are not biased toward a particular, prescriptive strategic decision process, and
6. The separation of operators from other types of relationships enhances the Elementary Mental Activities Model's value for strategic decision process research.

Two modifications to the Elementary Mental Activities Model are suggested based on the experience of coding the subjects' verbalizations and performing the data analyses.

1. Patterns should be removed from the entities, relationships, and operators information blocks in the Elementary Mental Activities Model. Attributes should remain.
2. Values of attributes should be added under attributes in each information box.

Further development of the coding of the verbalizations in the pilot study indicated that patterns of entities, and likewise relationships and operators, were best distinguished as either attributes of entities or separate entities. Values emerged as distinct from entities, relationships, operators, or their attributes.

6.4 Summary Implications for Strategic Decision Support

The results have the following general implications for designing and developing decision tools to support nuclear GOA managers engaged in strategic decision making:

1. Systems can be developed to collect, store, manipulate, information in anticipation of strategic problems facing strategic managers;
2. With today's state of understanding of the manager's information needs, the support systems will not provide all the information needed at the time the information is desired by the manager;
3. Support systems will be more effective if tailored to managers;

4. A support system considered adequate in supporting one manager will probably not be as adequate in supporting a different manager;
5. Half or more of the information maintained and provided by support systems must be about entities outside the manager's domain of responsibility, but it is equally important to maintain information about entities within the manager's domain of responsibility;
6. The primary focus of the information maintained should be on top-level status information about people, facilities, and products;
7. The most detailed data should be level 4 or level 5, internal and external facility data;
8. The support system must have the capability to predict the impact of managerial alterations on both internal and external people, facilities, and products; and
9. The capability of the support system to support higher order relationships will vary in importance from manager to manager.

6.5 Deficiencies in the Research

Several deficiencies exist in the research and should be noted. Suggestions are included in Chapter 7.0, *Summary, Conclusions, and Recommendations*, for further research to mediate or resolve these deficiencies.

1. EXERCISES: Not enough information was provided in the scenarios to enable the subject to reach a problem formulation or problem solution decision. Whereas this did not impede the determination of information needs significantly, it did not result in enough data to trace the entire decision process nor determine the nature of the resulting decision, i.e., if the manager made a strategic decision.

2. CODING: (a) The rules for coding were not developed enough to ensure repeatability. (b) The coding syntax could be enhanced to better capture the verbalizations. The coding rules and the coding syntax have a one to one relationship. The more developed the coding syntax is, the more structured are the rules for coding and thus the likelihood that two different people would code a sentence identically would be enhanced. What was important in this research was that the information in the verbalization was coded (1) captured in the coded protocols and (2) was properly represented as an entity, relationship, or

operator, and/or an attribute of such. Both objectives were accomplished. An improved syntax and rules would enhance the repeatability of the precise coding of sentences and the flexibility of the resulting data for analyses. For example, some parts of the sentence structure such as verb tenses and prepositional phrases were not separated in the coding syntax in a straight-forward manner. Had verb tenses been captured separately from the verbs themselves, then the assignment of time horizon to relationships and operators would be an objective procedure based on the tense of the verb. Repeatability in coding is not considered as important to the validity of the results of this research as is repeatability in the assignment of the information characteristics.

3. CHARACTERISTICS: Classes of entities, relationships, and operators and levels of detail of entities were not externally tested to provide any assurance of mutually exclusive values in a nominal scale. This the most significant deficiency in terms of the validity of some of the results and conclusions. Since testing of the classification of units of information and levels of detail of entities was not conducted other than by the researcher, the validity of the results is left to the reader as far as conclusions concerning these characteristics of information. Classes of entities and levels of detail of entities went through seven iterations of the constant comparative methodology. However, external review would have provided a better measure of reliability. Classes of relationships and operators went through two iterations of the constant comparative methodology, but were more easily classified than entities.

4. SUBJECTS: There were not enough subjects to enable statistical analyses. There was not enough time available with the subjects to conduct enough exercises to provide statistical analyses within subjects. Since the primary results are supported in the general literature on strategic decision processes, the impact of this on the validity of the results is mediated. It is not clear that it is feasible to conduct a study utilizing the methodology employed in this research on enough subjects and exercises to produce statistically verifiable results. The problem rests in balancing the subjects' strategic decision experience in the laboratory domain; the number of managers who qualify; the ability of the researcher to create realistic, varied, strategic scenarios for the laboratory domain; the amount of time the managers have to participate in the experiment; and the researcher's qualifications to translate the subjects' verbalizations about the domain.

5. STRATEGIC: The definitions for strategic problems, strategic decision processes, and strategic decisions were not developed and tested to arrive at objective definitions. The data analysis from the Exit Questionnaire by the subjects and the successful comparison of the results with the results in the literature on strategic decision processes mediate this deficiency. However, more research needs to be conducted to determine if objective definitions of strategic problems, strategic decision processes, and strategic decisions can be identified.

6.6 General Research Conclusions

The following conclusions are made regarding the research concepts and the research methodology. They are based on the entire set of data analyses, results, implications, and managerial conclusions presented in Chapter 5.0, *Results and Specific Analyses*, and in the previous sections of this chapter.

- The Elementary Mental Activities Model represents the information use of nuclear GOA managers engaged in strategic decision processes and characterizes their strategic decision processes in terms of information use.

This conclusion is supported by a) the result that the coded protocols adequately represent the subjects' verbalizations and b) the results and managerial conclusions are generally supported in the literature on strategic decision processes.

- The methodology developed based on the Elementary Mental Activities Model is useful in measuring the information use of nuclear GOA managers engaged in strategic decision processes for the purposes of determining information needs for designing decision tools.

This conclusion is supported by the discovery of patterns in the characteristics of information used by the subjects. The patterns in information characteristics enable decision support system designers to predetermine the information needs of nuclear GOA managers in a probabilistic manner. In addition, none of the

the experiments lasted for more than three hours, which indicates that the decision support system designer can determine information needs to support strategic decision making using only three hours of the manager's valuable time.

7.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

7.1 Summary of the Research

Nuclear government-oversight-agency (GOA) managers face increasing numbers of strategic decisions with fewer people to support their strategic decision processes. Therefore, there is an increasing need to find new means of strategic decision support for nuclear GOA managers. To do so requires understanding the strategic decision processes used and the characteristics of the information needed to support these processes.

There are three primary objectives of this exploratory research: (1) develop a set of contextual models of strategic decision making; (2) study the characteristics of the information needed by nuclear GOA managers when formulating strategic problems; and (3) propose implications of the concepts of information needs for designing and developing decision tools to support managers.

The body of literature surrounding managerial work and strategic management is extensive. However, the amount of literature dealing with strategic decision processes is limited. The literature reviewed in the areas of management, strategic management, decision making, decision tools, information characteristics, and procedures for studying managers forms the foundation for the development of the contextual models.

Three related models and a framework were developed to meet the first objective. First, a contextual model of strategic decision making was developed to identify and define the key components and subcomponents of strategic decision making. Second, a model of mental strategies was developed to include general problem solving approaches in the decision making processes. Third, a model of elementary mental activities represents the manager's strategic decision processes as an iterative process. The elementary mental activities model was developed at an appropriate level of detail to relate to the characteristics of information needed to support the manager. Finally, a framework of information characteristics was developed to allow experimentation and measurement of the information needs of a given population of managers.

An experiment was designed to engage five subjects, nuclear GOA managers, in realistic, strategic decision processes in a laboratory setting. The laboratory domain of responsibility was the United States Department of Energy's Office of Nuclear Materials Production in the time period of 1988 through 1989. Exercises consisting of a base description of the status of the laboratory domain of responsibility, a scenario of incidents, and an explicit question were developed to engage subjects in a variety of realistic, strategic decision situations. During each exercise, the subject was asked to verbalize their thinking. The subject's verbalizations were recorded and later transcribed creating the verbal protocols. After the subject finished each exercise, a structured interview was given to enable the researcher to validate the coded protocols.

A pilot study with two subjects was conducted to refine the exercises and to produce examples of raw data to enable developing data reduction and data analyses methods. A final study involving five subjects was conducted to generate the raw data needed to support the research objectives. Subjects for the final study were chosen from managers who had at least one year of experience making decisions or supporting decisions about the Office of Nuclear Materials Production during 1988 and 1989, and who had at least one year of experience making or supporting strategic decisions.

The method developed for coding the verbal protocols consisted of two steps. First, the verbal protocol was translated into a series of sentences. The translation step was necessary to clarify unclear references, to determine essential words and phrases, and to simplify compound and complex verbalizations. The second step involved coding each sentence to identify each unit of information according to type--entities, attributes, values, relationships, and operators--which constituted the sentence. A coding syntax patterned from the syntax structure for LISP, a computer programming language used in artificial intelligence applications, was developed to enable the data to be captured and manipulated partially by the researcher and partially by computer programs. The base description of the laboratory domain of responsibility and the five scenarios in the exercises were coded in addition to coding the verbal protocols. Table 7, *The Number of Sentences Coded and Units of Information in the Unique Lists*, shows the number of sentences coded by subject and by exercise. The resulting coded protocol database contains 1,230 coded sentences.

Table 7. The Number of Sentences Coded and Units of Information in the Unique Lists

NUMBER OF SENTENCES CODED

	Base	Scenarios	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Totals
	25							25
Exercise 1		9	15	50	108	53	22	257
Exercise 2		11	17	61	47	32	32	200
Exercise 3		10	34	98	80	40	33	295
Exercise 4		8	23	59	61	23	24	198
Exercise 5		12	30	96	62	29	26	255
Subtotals	25	50	119	364	358	177	137	1,230

NUMBER OF UNITS OF INFORMATION IN UNIQUE LISTS

TYPE	UNITS OF INFORMATION
Values	276
Attributes	131
Entities	270
Relationships	870
Operators	1,011
Total	2,558

Lists of unique values, attributes, entities, relationships, and operators were maintained during coding to ensure references by one subject were resolved with references by another subject. As shown in Table 7, *The Number of Sentences Coded and Units of Information in the Unique Lists*, 2,558 unique values, attributes, entities, relationships, and operators were identified as used by at least one of the subjects in at least one exercise or used in the base description or scenarios.

Two forms of usage of each type of information were calculated. By examining the coded protocols, the number of references to each unique value, attribute, entity, relationship, and operator was determined for each subject and exercise. This created a series of usage tables with the term use defined as the number of references to each unit of information. A second set of usage tables was then generated with the term use defined according to a binary scale--either the subject used the unit of information in the exercise (use = 1) or the subject did not use the unit of information in the exercise (use = 0). Both sets of tables were employed in the data analyses.

Information characteristics were assigned to the unique lists of entities, relationships, and operators. The information characteristics assigned to entities were:

1. source: where the entity originated--whether in the base description, one of the scenarios, or from a subject;
2. level of detail: from the perspective of the Director of the Office of Nuclear Materials Production, the grain size of the structural description necessary to yield the entity as a unit of information;
3. class: the generic group of entities to which the specific entity belongs; and
4. internal/external: whether the entity exists within or outside of the domain of responsibility of Director of the Office of Nuclear Materials Production.

The information characteristics assigned to both relationships and operators were:

1. class: the generic group of relationships or operators to which the relationship or operator belongs;
2. internal/external: whether the relationship or operator involves entities which exist within, outside, or both within and outside of the domain of responsibility of Director of the Office of Nuclear Materials Production; and
3. relationship complexity: the number of relationships and operators within the particular relationship or operator.

The information characteristics for and usage of each unit of information were linked with the unique lists of values, attributes, entities, relationships, and operators. This formed the second database--usage tables with information characteristics. Computer programs were developed to sort, select, link, and determine descriptive statistics using the usage tables with information characteristics and the coded protocols to search for meaningful patterns. The assignment of information characteristics and the search for patterns serves to demonstrate the utility of the contextual models developed in this research and embodied in the methodology employed.

To structure the data analyses, empirical generalizations were sought in thirteen views of the data. For example, the data were analyzed to compare the subjects' use of relationships and operators to determine if patterns of use existed which could constitute an empirical generalization. The empirical generalizations demonstrate the possibilities for data analysis rather than constitute an exhaustive analysis of the data.

The data analyses performed showed some degree of patterns in the use of units of information for a given subject. The analyses failed to reveal any patterns of the use of units of information across all subjects. With the limited number of information characteristics assigned to the units of information, several patterns of use in terms of characteristics of information were determined not only for a given subject, but for all subjects. These results were predicted and constituted a premise of the research--that patterns do not exist in the units of information managers use, but that patterns exist in the characteristics of the units of information managers use.

The empirical generalizations determined and their associated managerial conclusions are summarized in Table 8, *Empirical Generalizations and Managerial Conclusions*. The conclusions are stated in managerial terms. However, the scope of the research allows generalization only to nuclear GOA managers.

The following conclusions about nuclear GOA managers engaged in strategic decision processes are drawn from the results:

1. Managers have individual approaches to strategic problems which can, in part, be characterized by
    - the amount of time they spend understanding the situation versus the time spent considering managerial actions,
    - the entities of concern to the manager in most strategic decision situations, and

Table 8. Empirical Generalizations and Managerial Conclusions

EMPIRICAL GENERALIZATIONS	MANAGERIAL CONCLUSIONS
The ratio of the number of operators versus the number of relationships the subjects used was found to be consistent for a given subject in three out of five exercises and found to vary from subject to subject.	The amount of information a manager uses determining the situation versus acting on the situation is consistent for the manager for all strategic decision situations but varies from manager to manager.
A core set of entities was more consistent within subjects.	When faced with strategic problems, managers tend to have an individual focus of concern--a way of determining the impact of the incident(s) on their domain of responsibility. This set of entities varies from manager to manager.
Subjects used more units of information other than units of information provided in the scenarios.	Information representing strategic problems triggers the manager to consider a great deal more information.
Subjects used more level 1 and level 2 entities than other level entities and the greatest level of detailed entities used by subjects was level 5.	Managers use top-level information and rarely use detailed information in strategic problem formulation.
Most of the entities subjects used were of the people, facilities, and products classes.	Managers use relatively more information about people, facilities, and products than financial information in nuclear GOAs.
Subjects used more external entities than internal entities, but in three out of five subjects, and three out of five exercises, subjects referred to more internal entities than external entities.	The manager's process involves as much internal information as external but the manager uses information about more external entities.
Subjects used more level 4 and level 5 internal and external facilities and internal people classes entities than level 4 and level 5 entities in any other class.	The detailed considerations of the manager are about the facilities and people within the domain of responsibility and about the facilities outside the domain that have an impact on the manager's facilities and people.
Subjects used more assignment relationships than any other class of relationships.	Managers use more information about the values or relative values of entities, relationships, and operators than assessing impacts and implications.
For three out of five subjects, the subjects used more relationships other than assignment relationships that were both internal and external.	The majority of the manager's information concerns the impacts, implications, and order between or among entities, relationships, or operators that involve both internal and external entities, i.e., the manager is trying to determine the relationship between the managers domain and the domain environment.
The rank order of relationships and operators by relationship complexity was constant for all subjects and was one, two, three, four, and five.	Managers use more simple relationships and operators than complex relationships and operators.
Subjects used more alters operators than any other class of operators.	Managers consider more actions to alter the situation than any other actions, which implies the manager is trying to balance the domain with the domain environment, mediate the impact of the environment on the domain, or return the domain and environment to the status quo.
Subjects used more inquires operators than informs operators.	The net flow of information is in to the manager.
Each subject consistently used the same average relationship complexity in the coded protocol sentences and each subject varied in the average complexity for all sentences for all exercises.	Managers have a certain level of relationship complexity that they either are satisfied with, comfortable with, or capable of dealing with in strategic decision making.

- the complexity of the relationships and operators they employ in the strategic decision process.

This conclusion is supported by the work of Ramaprasad and Mitroff (1984) to link strategic decision processes with Piaget's (1974) theories of learning and the Jungian personality typology.

2. Units of information presented to the manager trigger the need for and use of more information that can be characterized as:
   - top-level,
   - status information, and
   - more external information than internal information.

   This conclusion is supported by the work of Mintzberg (1973) and Gorry and Scott Morton (1986).

3. Managers focus as much or more of their decision processes on dealing with internal information as external information.

   There was no reference to this conclusion found in the literature reviewed.

4. Managers are more concerned with people, facilities, and products than with finances in all levels of detail and in the most detailed levels of information.

   This conclusion differs from the central focus of financial information support for strategic decision making found in the literature, e.g., Keen and Wagner (1979), Treacy (1986), and Schwenk and Thomas (1983).

5. Managers attempt to re-balance their domain of responsibility with the domain environment by:
   - determining the current situation that exists between their domain of responsibility and the domain environment, and
   - determining ways to alter the situation.

This conclusion is supported in the literature by a number of researchers in strategic decision making, e.g., Mintzberg (1973), Gorry and Scott Morton (1986), and Simon (1960).

The results have the following general implications for designing and developing decision tools to support nuclear GOA managers engaged in strategic decision making:

1. Systems can be developed to collect, store, manipulate, information in anticipation of strategic problems facing strategic managers;
2. With today's state of understanding of the manager's information needs, the support systems will not provide all the information needed at the time the information is desired by the manager;
3. Half or more of the information maintained and provided by support systems must be about entities outside the manager's domain of responsibility;
4. The primary focus of the information maintained should be on top-level status information about people, facilities, and products;
5. The most detailed data should be level 4 or level 5, internal and external facility data;
6. The support system must have the capability to predict the impact of managerial alterations on people, facilities, and products; and
7. The support system must be capable of dealing with fifth order relationships and attributes of relationships and operators.

One modification to the contextual models is suggested based on the results of the experiment. Patterns should be removed from the entities, relationships, and operators information blocks in the Elementary Mental Activities Model. Attributes should remain. Values of attributes should be added under attributes in each information box.

Several deficiencies exist in the research and should be noted. In the last section of this chapter, suggestions are included for further research to mediate or resolve these deficiencies.

1. EXERCISES: Not enough information was provided in the scenarios to enable the subject to reach a problem formulation or problem solution decision. Whereas the determination of information needs was not impeded, the exercises did not result in enough data to trace the entire decision process or to determine the nature of the resulting decision, i.e., if the manager made a strategic decision.

2. CODING: The rules for coding were not developed enough to ensure repeatability. The coding syntax was not developed enough to capture verb tenses and prepositional phrases in a straight-forward manner.
3. SUBJECTS: There were not enough subjects to enable statistical analyses. There was not enough time available with the subjects to conduct enough exercises to provide statistical analyses within subjects.
4. CHARACTERISTICS: Classes of entities, relationships, and operators and levels of detail of entities were not tested to provide any assurance of mutually exclusive values in a nominal scale.
5. STRATEGIC: The definitions for strategic problems, strategic decision processes, and strategic decisions were not developed and tested to arrive at objective definitions in terms of the characteristics of information used.

7.2 Summary Conclusions

The specific results of the experiment enable conclusions about the information needs and strategic decision processes of nuclear GOA managers. These results and conclusions have implications for the design and development of decision tools to support nuclear GOA managers. Developing a methodology based on the contextual models for strategic decision making, applying the methodology, and obtaining useful results and conclusions leads to the following, overall conclusions.

1. The Elementary Mental Activities Model represents the information use of nuclear GOA managers engaged in strategic decision processes and characterizes their strategic decision processes in terms of information use.

   This conclusion is supported by a) the result that the coded protocols adequately represent the subjects' verbalizations and b) the results and conclusions are generally supported in the literature.

2. The methodology developed based on the Elementary Mental Activities Model is useful in measuring the information use of nuclear GOA managers engaged in strategic decision processes for the purposes of determining information needs for designing decision tools.

   This conclusion is supported by the discovery of patterns in the characteristics of information used by the subjects. The patterns in information characteristics enable decision support system designers to predetermine the information needs of nuclear GOA managers in a probabilistic manner. In addition, none of the experiments lasted for more than three hours, which indicates that the decision support system designer can determine information needs to support strategic decision making using only three hours of the manager's valuable time.

7.3 Recommendations for Further Research

The recommendations for further research that follow stem from the need to correct deficiencies in and enhance the methodology, to validate the research, to extend the generalizability of the results, to perform more exhaustive data analyses, to determine causal relationships, and to extend the knowledge gained into decision support research. The organization and brief discussions of the recommended research is intended to portray research activities.

7.3.1 Use and Extend the Current Databases

1. Revise coding syntax to more adequately handle prepositional phrases and verb tenses:
   This should enable the researcher to devise measures for the additional information characteristic of time horizon for not only entities but relationships and operators. This should also allow the researcher to devise programs to search for similarities in relationships and operators using the same entities and to search for the use of alternative relationships and operators.
2. Determine if desired outcome predictions and model outcome predictions can be identified:

This would enable the researcher to begin to assess the patterns of mental activities employed in the subject's strategic decision processes.

3. Assign additional information characteristics and search for patterns:

   Additional characteristics should be assigned to the units of information using both the researcher's knowledge of the laboratory domain of responsibility and by devising methods for assigning characteristics identified in the structured interviews.

4. Refine the categories in the class of entities, class of relationships, and class of operators scales:

   The categories in the classes need to be better defined and examined by other researchers to eventually determine a well-formed group of categories for each type of information. Classes of values and attributes should also be devised.

5. Devise data analysis methods for values, attributes, attribute/entity pairs, attribute/relationship pairs, and attribute/operator pairs:

   The analysis of information needs of nuclear GOA managers will not be complete until characteristics are assigned to all the types of information. For example, the information characteristic of qualitative/ quantitative should be assessed by examining the list and use of values. A comprehensive list of what information the subjects used will not be complete until attributes have been paired with entities, relationships, and operators.

7.3.2 Vary the Experimental Variables

1. Use the methodology based on the Elementary Mental Activities Model with different laboratory domains and subjects:

   The need exists to validate this research and the repeatability of the research methods.

2. Use the methodology with a laboratory domain that would enable enough subjects to qualify to produce statistically verifiable results.

   This would address the "SUBJECTS" deficiency in this research.

7.3.3 Develop Better Distinctions for Strategic

In general, the need exists to better define strategic problems, strategic decision processes, strategic decisions, and strategic information in the context of individual decision making. The following proposed research efforts would address some aspect of this need.

1. Construct a concept of strategic information.
   Based on the full characterization of the types of information in the databases and a more exhaustive data analysis using the characteristics, a concept of strategic information should be devised and tested.
2. Vary the problems from strategic to tactical and operational comparing the results.
   This research has determined the theory and methodology to adequately represent the information needs of nuclear GOA managers engaged in strategic decision processes. It might also be applicable to any decision making process.
3. Vary the subjects' experience from strategic to tactical and operational.
   Even though the exercises are considered strategic, the subject's decision processes need to be determined to be strategic.

7.3.4 Determine Causal Relationships

1. Determine the effect of personality traits on the characteristics of information needs.
   The question of why patterns are what they are remains to be addressed. This would expose the subjects to a greater experiment time, but could provide useful understanding.
2. Determine the effect of scenario characteristics on the characteristics of information needs.
   Strategic content research is focused on tracing of the effect of the types of strategic problems on the decision processes managers use. The existing databases could be used initially to determine the feasibility of finding such cause and effect. If the coding were enhanced and the data analysis methods devised to examine more of the decision processes, the likelihood of a successful research endeavor would be enhanced.

7.3.5 Use Information Boards

1. Devise a methodology employing information boards and compare the results.

   A characteristic of the methodology used was the lack of information provided to the subject during the exercise. The result was that no subject made a strategic decision. Devising a methodology employing information boards to provide the information the manager needs during the decision process should enable the researcher to measure the information needs from the first exposure to the problem to the final decision. This would allow a more comprehensive characterization of the information needs and of the decision processes.

7.3.6 Develop Decision Tools

The need exists to develop decision support tools based on the results of the research and to determine if the tools are successful. A number of possibilities for further research exist depending on the types of decision tools to be developed and tested. A few examples are presented here.

1. Development of a Facilities/Products/People database and model capability.

   The results imply the need for information about facilities, products, and people and the relationships among them.

2. Development of Support Training Programs.

   The information use and characterization of information use could be incorporated into a training program to enable support people to better support managers.

3. Decision Support Advisor.

   A great deal of knowledge has been captured and coded as part of this research. Given the LISP orientation of the coded knowledge, research should determine whether or not the knowledge base could form the foundation of a decision support system that in and of itself provides assistance in the form of advise to managers directly or to managers by advising their support people on the entities, relationships, and operators, and attributes of each to consider in the decision process.

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APPENDIX A. ENTRANCE QUESTIONNAIRES

The subjects' responses to the entrance questionnaire follow in boldface type. The order of the responses varies and, in some instances, the responses were edited to ensure anonymity.

1. What formal education have you had since high school? Please give degrees, majors, and schools.

   US Military Academy
   BS, Nuclear, Marine Engineering License, 3rd Engineer Steam and Motor Vessels, State University of New York Maritime College
   BS, Mechanical Engineering, LeHigh University
   BS, Chemistry, University of Pennsylvania
   BS, Industrial Engineering, Georgia Tech

   Operations Research courses, American University
   Intern program in the Oak Ridge School of Reactor Technology, basic nuclear engineering program, 1 year.

   MS, Mechanical Engineering, Rensiler Polytechnic Institute
   MS Civil Engineering, MIT
   MS Nuclear Engineering, MIT
   MA, Management and Supervision, Central Michigan University

2. What is your current position?

   Company:___**Consultant**_____
   Company:___**DOE**_____
   Company:___**DOE**_____
   Company:___**DOE**_____
   Company:___**DOE, Defense Programs**_____

   Organization: __**Defense Programs**_____
   Organization: __**Environmental Restoration and Waste Management**_____
   Organization: __**Self Employed**_____
   Organization: __**Defense Programs under the DAS/NM**_____
   Organization: ___**Office of Program Analysis and Financial Management**

   Position Title: _**Director**____
   Position Title: _**Director of the Office of Processing**____
   Position Title: _**N/A** _____
   Position Title: _**Associate Director for Waste Operations**____
   Position Title: _**Director, Office of Materials Planning**____

   Length of time in this Position: ____**approximately 2 or 3 months**___

Length of time in this Position: ____**about 1 1/2 to 2 years**___
Length of time in this Position: ____**1 year**_____
Length of time in this Position: ____**1 month** _____
Length of time in this Position: ____**approximately 1 year** _____

3. What are your responsibilities in your current position?

My job deals primarily with coordinating the preparation of the budget for Defense Programs which is about an 8 billion dollar a year activity. And our principle duties are preparing the budget, going through our internal processes within the Department, defending that budget for the OMB, and then finally defending it before the Congress and working with them in resolving as many problems as we can.

Twofold. There's a strategic planning function or a production planning and program planning. Program planning meaning how do you need to be configured for the future, how do you meet the nuclear materials requirements of the future, how do you need to be configured to do that. The production planning group is more concerned with number crunching, what are the outcomes of particular program and production initiatives you might have at any given time. In other words, for the facilities you have today, running at a particular capacity, what are you going to produce.

Manage the treatment, storage, and disposal of radioactive, mixed, and hazardous waste at all DOE facilities.

Providing information requested and supporting the contracts that I have.

I have responsibility for the operation and also the projects associated with the processing facilities at Hanford, at Savannah River, at Idaho, and a small effort at Los Alamos and at Oak Ridge, Y-12.

4. Have you ever been the Office Director of DOE's Office of Nuclear Materials Production (NMP)? If so, when and for how long?

No.

Yes and it was for 6 months, from November 87 to March or April of 88.

No, but I was acting Assistant Secretary of Defense Programs for approximately 6 months at one point and then acting Assistant Secretary again at a later date for about 9 months.

Yes. I was it's last director and I was the Director from April, 1988 until June, 1990.

No.

5. Have you ever been in a position that reports to or works closely with the Director of NMP? If so, when and for how long?

Yes.

In addition to the times mentioned above, from the period of 1980 to 1988 I was the manager of the Savannah River Operations Office that dealt with the Director of NMP on an almost daily basis.

Yes. I was the Director of Resource Management for the Nuclear Materials program which included Nuclear Materials Production and Defense Waste for about 2 years running from about early 86 to about the middle or latter part of 87. And then I was, so those were my direct experience with NMP. However before that, from about 81 to 86 I was in the Defense Waste program that interfaced considerably with the Nuclear Materials Production program.

Yes. I was the DAS for Nuclear Materials from March of 88 to around August of 89.

Yes. I have been the Director of the Operations Division approximately 3 years and worked very closely with the Office Director. And then I was the program manager for NPR for about a year and at that time worked closely with the Director of NMP. And then I was Chief of the Reactor Branch for several years and worked closely with the Director of NMP at that point.

6. Have you made or played a significant role in making decisions affecting the long-term operations of NMP's Complex? (Yes or No)

Yes.

Yes.

Yes.

Yes.

Yes.

6.a How long were you or how long have you been in the position of making these decisions?

2 years

3 or 4 years

A couple of years. I might add that in my current position the nuclear materials program is under us and therefore I am involved in it still, but probably not as closely as I was before. I have a division director that reports to me who basically fills my previous job.

4 years

8 years

6.b Please briefly describe several of the decisions you made or helped make.

The major area was in the overall planning and recommendations to the Secretary as to what the complex should look like in the future. And there were several discussions on where the work should be done and what facilities should be built to accommodate them.

I was heavily involved on the decision on N-reactor shutdown. Many of the decisions like the NEPA decisions on the reactors, the Savannah River reactors, the L-reactor. Decisions on upgrades for the reactors and for the processing facilities. Budgets on the facilities.

I've been involved in how quickly should we try to make corrections at Savannah River with the new culture. Admiral Watkins is talking about, from a financial perspective, how quickly can we do things. How quickly can we hire staff, bring them on, get them cleared? I was involved directly in those activities this past year. We've also been involved in long-term technology decisions on the Special Isotopes Separation project and whether that was absolutely needed from a requirements point of view.

I think one of the most significant was to shutdown N-reactor which occurred just in the transition between moving between my moving from Office of Nuclear Materials up to DAS for Nuclear Materials. So that was one of our first decisions up there.

The shutdown of the Savannah River reactors. The decision to shutdown the reactors one-by-one as they went down. And the decisions on how we would bring them back up and the criteria we would use and how we would deal with

the oversight groups on how we would bring them back up. Of course that was changed considerably. That has evolved from that time. But that was a very significant decision at the time.

I would say also the decision to see if we could privatize the supply of depleted uranium that was coming from Fernald so that we could phase out of Fernald. It was the initial decision to go out with that study on how to phase out of Fernald.

For example, the N-reactor, were we involved with that, yes to a point. Interestingly enough, at the time that that reactor was taken down for a stand-down, which was really where the demise actually began, we were kind of fighting it. As the scenario unfolded over the last couple of years, however, we were instrumental in determining it ought to be put into one standby condition versus another and now into dry lay-up.

Similarly, right now, the fate of the Purex Plant at Richland, in light of the current needs for materials, is going to be driven by NMP as well as by others. You could actually say the configuration of the production facilities of the future, those decisions are being made even now. So it's an on-going thing.

7. In your current job or in previous jobs, have you made or played a significant role in making decisions affecting the long-term strategies, goals, objectives, or operation of your organization? If so, when and for how long?

Yes. For the last 3 or 4 years.

My major supervisory positions started back in about 1981, that was when I was with the Defense Waste program and then going through all those other things I talked about. I have been involved in the planning activities that deals with what should be our long-term strategies, goals, and objectives and have had an input then from, again, principally from the financial point-of-view. And that's probably a word that's kind of, it's hard to define what that means. But from a pure technical sense, it wasn't based on absolute technical judgements as to whether things should happen. It's more is it possible, is it efficient, is it those kinds of things that need to be done? So therefore, I have been involved in these kinds of things for about 9 years.

Yes.

Primarily when and how long it was as the Manager of the Savannah River Operations Office for 8 years,

Yes.

7.a Please describe several of the decisions you made or helped make.

which we decided what facilities we should have. Was instrumental in doing the lobbying on the Hill after getting approval within DOE for the Defense Waste Processing Facility, and other objectives of facilitization and clean up.

The desire to build new capability are major decisions and there were any number of those being made. New special recovery at Savannah River, I was certainly instrumental in the need and desire to build that facility at Savannah River. The replacement tritium facility at Savannah River, I was involved in that, but that's not NMP's facility.

Before I was in Nuclear Materials, I waste in Waste Management for about a year and a half. And in that position we worked on, we started the Hazwrap Program. So that was a major move. Dealing with that, we redid the, decided to redo the DOE order on waste management to make it a prescriptive order which is a very different strategy on how to go forward with the program from then on. We had the WIPP project went through, started into its major transition at that time. Although I don't think that was. Looking back on it, it was the start of a major change in the WIPP project, but I'm not sure we recognized it at the time. It was a decision to get outside regulators in on the transportation package--the TRU-Pac, and we saw this was the beginning of a process of the Department moving into more outside regulation. But I'm not sure we understood how important that decision was.

And then if I go back before that, I spent 16 years in the Office of Classification. After the first 4 or 5 years that I was an analyst there, I was involved in policy. I was the Director of the Policy Division. So, I did all of the studies on the objectives of the program. We did a study on merger with the Department of Defense's program. We did several studies on how we should operate the organization, field versus headquarters. Whether the field offices should report to us. So there were several strategic planning cases.

One of the things I was involved in was in 1983 we published the Defense Waste Management Plan which was the first time we'd ever tried to document where we were going in that program. And that was a very significant milestone and I was involved in some of those decisions. And basically what my charter usually winds up being is defending some of these things from a logic after somebody's made the decision. Trying to help communicate the thing and make it understood and supportable. We've had a lot of things where recently, not related to Nuclear Materials Production, but questions of where should the level of laboratory staffing in our national laboratories go, what should be the, it's very hard to make a quantitative decision on how you trade off RD&T versus immediate production requirements. That's a very difficult problem. The same thing goes with how do you make long-term investment decisions when you hardly have enough money to operate facilities that you currently have. So some of those things are kind of where I have probably been involved the most.

Certainly NEPA strategies and budget strategies (are the same as 6.b.) When I had the NPR, it was a strategy of the R&D and cost estimates that we pursued. And I think more recently for the processing facilities, it was coming up with the priorities on what we were going to support for the processing facilities. And with the change in emphasis with the new Secretary, the approach we were going to take on our processing facilities for implementing that.

8. Have you been in a position other than the Office Director of NMP with managerial responsibilities for facilities within NMP's complex? If yes, when and for how long?

   No.

   Yes.

   Yes. It's nearly 20 years.

   Yes. 4 and 1/2 years.

   Yes. about 4 years.

(For questions 9 through 17, the number of subjects responding with a given value is placed to the left of the value.)

9. How often do you procrastinate in making high-level decisions about the NMP Complex?
   - a. Always
   - **1** b. Usually
   - **3** c. Sometimes
   - **1** d. Seldom
   - e. Almost never
   - f. Never

10. Would you welcome the chance to make more high-level decisions about the NMP Complex?
    - **2** a. Yes
    - b. Probably yes
    - **3** c. Probably no
    - d. No

11. How did you feel about making high-level decisions about the NMP Complex?
    - **1** a. Very good
    - **3** b. Fairly good
    - **1** c. About average
    - d. Not too good
    - e. Not at all good

12. When you get information to support high-level decisions, do you like to examine the detailed numbers?
    - a. Always
    - **3** b. Usually
    - **1** c. Sometimes
    - **1** d. Seldom
    - e. Almost never
    - f. Never

13. When you are making high-level decisions, do you like for your staff to give you the bottom-line up-front?
    - **3** a. Always
    - **2** b. Usually
    - c. Sometimes
    - d. Seldom
    - e. Almost never
    - f. Never

14. When you get information to support high-level decisions, do you like to look at graphs?
    - **1** a. Always
    - **3** b. Usually
    - **1** c. Sometimes
    - d. Seldom
    - e. Almost never
    - f. Never

15. When you get information to support high-level decisions, do you like to look at tables?
    - a. Always
    - **2** b. Usually
    - **3** c. Sometimes
    - d. Seldom
    - e. Almost never
    - f. Never

16. When you think through a difficult problem, how often do you draw pictures to help you think through the problem?

1 a. Always
2 b. Usually
1 c. Sometimes
1 d. Seldom
e. Almost never
f. Never

17. When you think through a difficult problem, how often do you write words to help you think through the problem?

a. Always
2 b. Usually
2 c. Sometimes
1 d. Seldom
e. Almost never
f. Never

APPENDIX B. TRANSCRIPTS, TRANSLATIONS, AND CODED PROTOCOLS

The following sections present the transcripts of the subjects' verbalizations during each exercise with the corresponding translations and coded protocols. The subjects were allowed to edit the transcripts for publication purposes. The unedited transcripts were used to create the translations. The subjects' verbalizations are printed in boldface type.

B.1 Subject 1

B.1.1 Subject 1, Exercise 1

B1.1.1 Transcript

Ah. Again on the scenario, ah, the Gorbachev and Bush arms limitations talks do not play until there are treaties. We still have the Presidential Stockpile Memorandum to be responsive to. And that's my job to provide the material for that.
Regarding the Congressional aspects of that, I would first go at asking people to prepare appropriate testimony on the anticipation of hearings. As to why we needed the money that we had to keep the facilities running. And I assume that the budget we're talking about is a cut in the budget from what was needed and that it wasn't 25% inflated.
Regarding the Washington Post article on contamination at Rocky Flats, I would have assumed, I will assume for the purpose of this exercise that I would have been duly apprised of that situation and fully briefed on it and that we would respond not only to any inquiries in the public format, but we would also be dealing with the Congress and the appropriate committees on the Hill as to making sure they understood what the facts were regarding that.
And again on one of the reactors being shut down at Savannah River, I'd like to know which one, what type of charge it was on, what the anticipated down time was, and find out what the implication of that would be on the material production and our ability to meet the Presidential Stockpile Memorandum.

B.1.1.2 Translation

The Gorbachov and Bush arms limitations talks have no impact on NMP activities until there are treaties. The Director of NMP must provide the material called for in the current Presidential Stockpile Memorandum.

If congressmen want to cut the budget by 25%, then there will probably be hearings.
The Director of NMP directs staff to prepare appropriate testimony.
The testimony should address that we need the current budget to keep the facilities running.
The current budget is not inflated by 25%.
The proposed 25% cut in budget is 25% less than the current budget.
The Director of NMP would have been informed by someone about the Washington Post article on contamination at Rocky Flats.
NMP staff would respond to inquiries by the general public concerning the Washington Post article on contamination at Rocky Flats.
NMP staff would inform the Congress and appropriate committees of Congress about the Washington Post article on contamination at Rocky Flats.
The Director of NMP inquires of someone which reactor was shutdown.
The Director of NMP inquires of someone what type of charge was the reactor on when reactor was shutdown.
The Director of NMP inquires of someone what is the anticipated down time of reactor was shutdown.
The Director of NMP inquires of someone the impact of reactor was shutdown on the total production of nuclear materials over time.
The Director of NMP inquires of someone NMP's new ability to meet demand set forth in the Presidential Stockpile Memorandum.

B.1.1.3 Coded Protocol

{IFTHEN:NO-IMPACT |{EQUALS |(Signed treaties), "dont exist"|}, (Arms limitation talks), (NMP activities)|}
{PROVIDES |(Director of NMP), (Nuclear material called for in the current Presidential Stockpile Memorandum)|}
{IFTHEN |{EQUALS |(Proposed budget cut), "true"|}, {EQUALS |(Congressional hearings), "true"|}|}
[DIRECTS |(Director of NMP), (Staff), [PREPARE |(Testimony on budget cuts)|]|]
{INCLUDES |(Testimony on budget cuts), {EQUALS |(NMPs current budget), (Amount of money to run NMP facilities)|}|}
{ISNOTEQUAL |'margin-of'(NMPs current budget), "inflated by 25%"|}
{LESSTHAN |(Proposed budget cut), (NMPs current budget), "By-25%"|}
[INFORMS |(Someone), (Director of NMP), 'ALL'(Article on another incident of contamination at Rocky Flats)|]
[ANSWER |(Staff), (Questions from the general public), 'ALL'(Article on another incident of contamination at Rocky Flats)|]
[INFORMS |(Staff), (Congress) AND (Congressional Committees), 'ALL'(Article on another incident of contamination at Rocky Flats)|]
[INQUIRES |(Director of NMP), (Someone), 'which'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), 'what-type-of-charge-was-current'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), 'anticipated-down-time-of'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), 'impact-on-production'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), {WHATIS |(NMPs new ability to produce material), 'demand-for-nuclear-materials'(Presidential Stockpile Memorandum)|}|]

B.1.2 Subject 1, Exercise 2

B.1.2.1 Transcript

If there was an agreement to reduce the number of nuclear weapons in Europe, I would ask OMA, the weapons production side, if they knew what the weapons were and the numbers and how that would affect the nuclear materials requirements in the Presidential Stockpile Memorandum. That would be most important. What the impact of need was on the material production side.
Last week the FBI agents seized the Rocky Flats Plant and secured all files. Rocky Flats Plant belongs to the Weapons Production side. I would have to ask the Weapons Production People what impact that would have on material requirements and needs that would be going into the Rocky Flats Plant.
K Reactor is down with problems. I'd like to know what the problems were. And what the fixes were or proposed or recommended by the Savannah River Operations Office.
L Reactor is still operating normally. We just found the Washington Post had run an article stating they had an internal DOE contractor, okay.
Certainly, I'd send some people off on the safety and security side to find out what the safety analysis was and what the impact that that would have on operations. And prepare to deal with any inquiries that would come as a result of that. And then further briefing appropriate, preparing to brief appropriate Congressional and your senior management. And I would send people off scurrying to get that done.

B.1.2.2 Translation

The Director of NMP inquires of someone what SR's plans for restarting K-reactor are.
L Reactor is still operating normally.
The Washington Post article on the safety analyses.
The Director of NMP directs Safety and Security Staff to determine what the analyses were and what impact that might have on NMP activities.
The Director of NMP prepares to answer questions about the safety analyses.
The Director of NMP prepares to brief Congressional committees about the safety analyses.
The Director of NMP prepares to brief superiors about the safety analyses.
The Director of NMP directs staff to prepare briefings on the safety analyses.

B.1.2.3 Coded Protocol

[INQUIRES |(Director of NMP), (Someone), 'SRs-plans-for-restart'(K-reactor)|]
{EQUALS |'status-of'(L-reactor), "normal"|}
[CONSIDERS |(Director of NMP), (Article on an internal DOE contractor memo about safety analyses)|]
[DIRECTS |(Director of NMP), (Safety and Security staff), [DETERMINE |(Safety and Security staff), 'ALL'(Reactor safety analyses), AND 'impact-on-production'(Reactor safety analyses)|]|]
[PREPARES |(Director of NMP), [ANSWER |(Director of NMP), (Questions about safety analyses)|]|]
[PREPARE |(Director of NMP), [BRIEF |(Director of NMP), (Congressional committees), (Reactor safety analyses)|]|]
[PREPARE |(Director of NMP), [BRIEF |(Director of NMP), (Superiors), (Reactor safety analyses)|]|]
[DIRECTS |(Director of NMP), (Staff), [PREPARE |(Director of NMP), (Briefings on safety analyses)|]|]

B.1.3 Subject 1, Exercise 3

B.1.3.1 Transcript

This is a "catch 22" I think, if all, it's crazy. This governor of Ohio situation of stopping shipments. First thing is whether that's legal or not and you've got to pursue that and get on with that aspect. And that's not the responsibility of material production people, but you turn that over to the Chief Council and say along with letting the Deputy Assistant Secretary for Military Applications, or the Deputy Assistant Secretary for Defense Programs pursue that, you needed help at this point in time. So you throw that one up a notch and let them deal with it.

And by the way, as an aside, with all the reactors down, you don't need shipments out of Fernald anyway. So you're in a crisis mode now dealing with one of the leaks at FMPC. Now again on that one, I would want to find out from the Manager of Oak Ridge, what the hell was going on. And in this case, from him directly. And what the cause, what the solution, how he's going deal with that locally. And then I've got to deal with that in the Washington arena and brief appropriate people.

With all the reactors down at Savannah River, the first question is what in the hell is the problem. Why are they down? When are they going to get back on? And, whether we have an endemic problem situation now coming up. In other words, if all of them are down you might have an endemic problem which says we have lost it. Which is one of the concerns which you always have on a single-source or single-type machine.

Okay. So I'd deal with trying to find out what the reactors, what was wrong with them, provide the appropriate resources to Savannah River to fix them. That goes without saying.

On the bullet number four, you just returned from Forrestal where I heard rumors of reorganization because of the problems with the production complexes. Ah, you can hear that rumor or any other rumor that you want and I normally spend no time listening or even doing anything about them. That doesn't even come into a decision process.

Since the Deputy Assistant Secretary for Military Applications is at the same level that I am, I wouldn't let that bother me either. And I might even give him a shot back as to what the hell was going on at Rocky Flats. So you don't need any of this stuff so what the hell are you bugging me for?

All I have to do is take care of the tritium recycle. And, because nothing is coming out of Rocky they aren't going to be doing them at Pantex. So, I don't have to worry about that, so I'm probably going to be able to meet everything. The question with Rocky, and I assume Rocky is still shut down, or is this a separate exercise? Oh, okay, I'm sorry.

I'd take the courtesy to tell him what the hell I'm doing about things at Savannah River--about trying to get those back on-line. But there's not much else I can do to him. But I'd keep his boss and my boss informed.

That's about all. Again I don't, you know you can run around in circles on these things and try to make a decision or decision to do something. But, when you get facts, then you make the decision of providing resources to get reactors back on-line. But the first priority is getting reactors back on-line. And then dealing with this other thing. Now if the reactors. Well, the same still goes, that isn't going to bother me. That's for somebody else to handle. And then we've got to find out what the problem is at Fernald. But priority number one is the reactors. And when I get information, I'll make a decision.

B.1.3.2 Translation

The governor of Ohio stopping shipments is a "catch 22".
The Director of NMP inquires of the Chief Council about the legalities of the governor of Ohio stopping shipments.
The governor of Ohio stopping shipments is not an issue for the Director of NMP to deal with.
The Director of NMP passes dealing with the governor of Ohio stopping shipments to the Chief Council and to the DAS/MA, and to the AS/DP.
If the all the reactors are shut down, no shipments from Fernald are needed.
The Director of NMP is in a crisis mode dealing with the leak at FMPC.
The Director of NMP inquires of the Manager of OR about the leak at FMPC.
The Director of NMP inquires of the Manager of OR what caused the leak at FMPC.
The Director of NMP inquires of the Manager of OR what is the solution of the leak at FMPC.
The Director of NMP inquires of the Manager of OR what is the local plan of action for the leak at FMPC.
The Director of NMP briefs someone about the leak at FMPC.
The Director of NMP inquires of someone what is the problem with all the SR reactors being down.
The Director of NMP inquires of someone why all the SR reactors are shut down.
The Director of NMP inquires of someone when all the SR reactors will be restarted.
The Director of NMP inquires of someone if the problem with the SR reactors is an endemic problem.
If the problem is an endemic problem, then the reactors may be shut down forever.
Endemic problems are a concern with a single-type machine.
The Director of NMP inquires of someone what is the problem with all the SR reactors being down.
The Director of NMP provides the resources necessary to fix the problem with the SR reactors.
The Director of NMP does not consider the rumors of reorganization important.
Since the DAS/MA is at the same level as the Director of NMP, the DAS/MA expressed displeasure with the Director of NMP has no effect on NMP activities.
The Director of NMP inquires of the DAS/MA the situation at RFP.
The Director of NMP must provide for tritium recycle.
With no production from RFP, there will be no assembly at Pantex.
Demand for nuclear materials will be less and the supply of nuclear materials will be adequate.
The Director of NMP briefs the DAS/MA about the plans for restart of all the SR reactors.
The Director of NMP informs the AS/DP about the plans for restart of all the SR reactors.
When the Director of NMP gets facts, then the Director of NMP provides resources to restart all the SR reactors.
The first priority is getting the SR reactors restarted.
The second priority is fixing the leak at FMPC.
The governor of Ohio stopping shipments if for the Chief Council and the AS/DP to handle.
The Director of NMP inquires of someone what is the problem with the leak at FMPC.
The first priority is getting the SR reactors restarted.
When the Director of NMP gets facts, then the Director of NMP makes a decision.

B.1.3.3 Coded Protocol

{EQUALS I'nature-of',[STOPPED I(Governor of Ohio), (Shipments of nuclear materials through Ohio)I], "catch 22"I}
[INQUIRES I(Director of NMP), (Chief Council), 'legality-of',[STOPPED I(Governor of Ohio), (Shipments of nuclear materials through Ohio)I]I]

[DOESNOTHANDLE |(Director of NMP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]|]
[REFERSTO |(Director of NMP), (Chief Council), AND (DAS/MA), AND (AS/DP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]|]
{IFTHEN |{EQUALS |'status-of'(SR reactors), "shut down"|}, {EQUALS |'number-of'(Shipments needed from FMPC), "0"|}|}
[CRISIS |(Director of NMP), (Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'ALL'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'reason-for'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'problem-solution-for'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for-solution-of'(Leak from one of the tanks at FMPC)|]
[BRIEF |(Director of NMP), (Someone), 'ALL'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'reason-for',{EQUALS |'status-of'(SR reactors), "shut down"|}|]
[INQUIRES |(Director of NMP), (Someone), 'reason-for',{EQUALS |'status-of'(SR reactors), "shut down"|}|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for-restart',{EQUALS |'status-of'(SR reactors), "shut down"|}|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'reason-for',{EQUALS |'status-of'(SR reactors), "shut down"|}, "endemic problem"|}|]
{IFTHEN |{EQUALS |'reason-for',{EQUALS |'status-of'(SR reactors), "shut down"|}, "endemic problem"|}, {EQUALS |'status-of'(SR reactors), "considered permanently shutdown"|}|}
{OFCONCERN |(Endemic problems), (Single-type machines)|}
[INQUIRES |(Director of NMP), (Someone), 'reason-for',{EQUALS |'status-of'(SR reactors), "shut down"|}|]
[PROVIDES |(Director of NMP), (SR), (Resources), [RESTART |(SR), (SR reactors)|]|]
[CONSIDERS |(Director of NMP), {EQUALS |'value-of'(Plans for reorganization of DOE), "not important"|}|]
{IFTHEN:NOEFFECT |{EQUALS |'level-of'(DAS/MA), 'level-of'(Director of NMP)|}, [EXPRESSEDDISPLEASURE |(DAS/MA), (Director of NMP)|], (NMP activities)|}
[INQUIRES |(Director of NMP), (DAS/MA), 'ALL'(RFP)|]
[PROVIDES |(Director of NMP), (Tritium recycle)|]
{IFTHEN |{EQUALS |'status-of'(RFP), "shut down"|}, {EQUALS |'status-of'(Pantex), "no production"|}|}
{IFTHEN |{EQUALS |'status-of'(RFP), "shut down"|}, {EQUALS |(Supply of nuclear material), (Demand for nuclear material)|}|}
[BRIEF |(Director of NMP), (DAS/MA), 'plan-for-restart'(SR reactors)|]
[INFORMS |(Director of NMP), (AS/DP), 'plan-for-restart'(SR reactors)|]
[WHEN |[RECEIVES |(Director of NMP), (SR), 'ALL'(SR reactors)|], [PROVIDES |(Director of NMP), (SR), (Resources), [RESTART |(SR), (SR reactors)|]|]|]
{EQUALS |'priority-of',[RESTART |(SR), (SR reactors)|], "first"|}
{EQUALS |'priority-of',[FIXING |(OR), (Leak from one of the tanks at FMPC)|], "second"|}
[ADDRESSES |(Chief Council), AND (AS/DP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]|]
[INQUIRES |(Director of NMP), (Someone), 'ALL'(Leak from one of the tanks at FMPC)|]
{EQUALS |'priority-of',[RESTART |(SR), (SR reactors)|], "first"|}
[WHEN |[RECEIVES |(Director of NMP), (facts)|], [DECIDES |(Director of NMP), (Something)|]|]

B.1.4 Subject 1, Exercise 4

B.1.4.1 Transcript

Okay. The fact that the presidential elections are over and George Bush won is a nice bit of information, but something I don't feel that I should be dealing with other than what impact that may have on future requirements. And I'd wait for those to happen.
DOE environmental managers have won against you in an internal battle ending in the Secretary shutting down the reactors today for an environmental review. Ah. That's a fact that somebody else had made a decision for me. I would have to say that depending on what information was provided and whether I agreed with it and that if I took a different view, I might resign as of that day. So, you give me some further data on this and I will tell you what my decision will be.
I would first alert the people that they were going to have an environmental review. And to get ready for that and to give them the reasons and rational that the Secretary based his decision on so that they could proceed accordingly in preparation for that environmental review. And then resign.
Some congressmen are still pushing a new production reactor capability. I assume throughout this thing that we were dealing with an NPR and that I would be supporting that very hard, and had been supporting it in the past.
I would find out who the congressmen were, what their influence was, and what their committees were, and certainly nurture that support and try to make sure that support was known to the appropriate authorization and appropriation committees.
I would prepare, I'd send off people, get the information as to what's transpired relative to the reactors and prepare to defend myself against the House Armed Services Committee staff and principles. And tell them what we were doing in order to get on with it. And I'd have to testify to tell them why the Secretary had shut it down, after, I mean, if I got his permission to do so, as to my understanding what those reasons were.
I guess the decision here is to push hard on a new production reactor. And that, to get people in shape for the environmental review, and those are, and then get ready for the hearings. Those are the only things I can see.

B.1.4.2 Translation

The Director of NMP would wait for any impact the presidential elections might have on the demand for nuclear materials.
The Secretary of Energy shut down all the reactors for an environmental review.
The fact is someone other than the Director of NMP made a decision for the Director of NMP.
Depending on what information was provided and whether the Director of NMP agreed with the decision to shut down the reactors, the Director of NMP resigns.
The Director of NMP informs staff of the environmental review.
The Director of NMP informs staff of the reasons for the Secretary of Energy shutting down the reactors.
Staff should prepare for the environmental review.
The Director of NMP resigns.
Some congressmen support a new production reactor capability.
NPR exists.
The Director of NMP supports NPR.

Who are the congressmen supporting NPR.
What's the influence of the congressmen supporting NPR.
What committees are the congressmen on who support the NPR.
The Director of NMP nurtures the congressmen who support NPR.
The Director of NMP informs authorization and appropriation committees about congressmen supporting NPR.
The Director of NMP inquires all information about the reactors being shut down.
The Director of NMP prepares defense for HASC and committee principles.
The Director of NMP informs HASC of NMP's plans for the environmental review.
If the Director of NMP received approval from the Secretary of Energy, the Director of NMP would inform the HASC of the Secretary's reasons for shutting down the reactors.
The Director of NMP would push for a new production reactor.
The Director of NMP would prepare staff for the environmental review.
The Director of NMP would prepare for HASC hearings.

B.1.4.3 Coded Protocol

[WAIT |(Director of NMP), {WHATIMPACT |(Presidential elections), (Demand for nuclear material)|}|]
{EQUALS |'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "environmental review"|}
[MADE |(Someone other than the Director of NMP), (NMP decision)|]
{DEPENDSON |(Information provided), AND (Agreement with decisions), [RESIGNS |(Director of NMP)|]|}
[INFORMS |(Director of NMP), (Staff), 'ALL'(Environmental review)|]
[INFORMS |(Director of NMP), (Staff), 'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|]|]
[PREPAREFOR |(Staff), (Environmental review)|]
[RESIGNS |(Director of NMP)|]
[SUPPORT |(Some congressmen), (New production reactor capability)|]
{EQUALS |'existence-of'(New production reactor capability), "exists"|}
[SUPPORT |(Director of NMP), (New production reactor capability)|]
[INQUIRES |(Director of NMP), 'who',[SUPPORT |(Some congressmen), (New production reactor capability)|]|]
[INQUIRES |(Director of NMP), 'influence-of',[SUPPORT |(Some congressmen), (New production reactor capability)|]|]
[INQUIRES |(Director of NMP), 'committees-of',[SUPPORT |(Some congressmen), (New production reactor capability)|]|]
[SUPPORTS |(Director of NMP), [SUPPORT |(Some congressmen), (New production reactor capability)|]|]
[INFORMS |(Director of NMP), (Authorization and appropriation committees), [SUPPORT |(Some congressmen), (New production reactor capability)|]|]
[INQUIRES |(Director of NMP), (Someone), 'ALL',[SHUTDOWN |(Secretary of Energy), (All reactors)|]|]
[PREPARES |(Director of NMP), (Defense for HASC meeting)|]
[INFORMS |(Director of NMP), (HASC), 'plan-for'(Environmental review)|]
[IFTHEN:INFORM |{EQUALS |'existence-of'(Secretarys agreement), "exists"|}, (Director of NMP), (HASC), 'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|]|]
[SUPPORT |(Director of NMP), (New production reactor capability)|]
[PREPARE |(Director of NMP), (Staff), (Environmental review)|]
[PREPARES |(Director of NMP), (Defense for HASC meeting)|]

B.1.5 Subject 1, Exercise 5

B.1.5.1 Transcript

On the WIPP situation, I'd certainly like to find out what the problems are of having it come on-line, estimated time and all. I'd like to understand that issue. If it's valid. But, that one, I just feel I must validate. Then get an estimate on when it is going to come on-line and what the impacts are going to be on that. And where we're going to have to find alternate places because of storage requirements.
I would say that rumors have floated in Washington for the past 15 years as to whether WIPP would ever make it. Many of them while I was there and involved with WIPP. So that I wouldn't worry about that one either. The rumors, forget it.
Reactors have been shut down. I assume that since I'm doing this exercise number 5, I'm still there so I didn't resign. But I might after this one.
Intends to create a special task force for restarting them. This is a, excuse me, again I've got to remember a new one just a step different. The only thing I'd do on that is keep people informed as to who was going to do what they were looking at, how long that was going to take, and again, the decision is out of poor ONMP's, Nuclear Material Production's hands.
A recent report by one of your division directors indicated major break-through's in SIS technologies. I wouldn't believe them. I won't deal with that.
Certainly it's been a position within the Department that, there's no reference to what the current status is. If there had not, if there was a line item project in it, I'd see what I could do to accelerate it. If not I'd go for special situation, maybe. But I'd want to find out what the quote break-through's before I would do anything. Because that's been a lot of smoke and mirrors, in my humble opinion. It doesn't make any new material. It utilizes some material that's currently existing. And it's too far off to worry about and if we don't get the other reactors started, SIS isn't going to do us any good anyway. So I, looking at this, that's a throw-away.
Two new stockpile cases a week, suspected you know resulting from various Gorbachov talks. I'd want a briefing on every one of those a day after they got it to look at that, what that was going to do to my need requirements just to keep that thing going.
As ONMP Director, I don't see him doing anything or any decisions. Just trying to get information to get ready for the next one.

B.1.5.2 Translation

The Director of NMP inquires what the problems are that the status of WIPP in nowhere near the estimated time.
The Director of NMP inquires what the estimated startup of WIPP is.
The Director of NMP inquires all about WIPP.
The Director of NMP validates the WIPP situation.
The Director of NMP inquires what the estimated startup of WIPP is.
The Director of NMP inquires what the impact of WIPP delays will be on NMP activities.
The Director of NMP inquires what alternate storage locations exist.
Rumors have existed about WIPP never starting up for 15 years.
The rumors are not important.
All the reactors are shut down.

The Director of NMP didn't resign.
The Secretary of Energy intends to create a special task force for restarting all the reactors.
The Director of NMP informs his staff all about the restart of the reactors.
The Director of NMP informs his staff about the schedule for restarting the reactors.
Someone other than the Director of NMP has made a decision for the Director of NMP.
A recent report by one of your division directors indicated major break-through's in SIS technologies.
The Director of NMP doesn't believe the report to be true.
The Director of NMP wont deal with the report.
If SIS was a line-item project, the Director of NMP would try to accelerate the project.
If SIS was not a line-item project, the Director of NMP would try to make a special case for SIS.
The Director of NMP inquires about the SIS break-through's before taking action on SIS.
SIS has not proven to be a useful technology.
SIS does not produce new material.
SIS utilizes some existing material.
The date of start up of SIS is too far off to have a significant impact on NMP activities.
If the reactors are not restarted, SIS is of no benefit.
The major break-through's in SIS are not important.
Two new stockpile cases per week.
The Director of NMP is briefed on the new stockpile cases one day after DAS/MA gets the new stockpile case.
The Director of NMP inquires the impact of the new stockpile cases on the demand for nuclear material.

B.1.5.3 Coded Protocol

[INQUIRES |(Director of NMP), (Someone), 'nature-of-problem',{EQUALS |'status-of'(WIPP), "nowhere near the estimated time"|}|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for-startup'(WIPP)|]
[INQUIRES |(Director of NMP), (Someone), 'ALL'(WIPP)|]
[VALIDATES |(Director of NMP), {EQUALS |'status-of'(WIPP), "nowhere near the estimated time"|}|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for-startup'(WIPP)|]
[INQUIRES |(Director of NMP), (Someone), {IMPACT |{EQUALS |'status-of'(WIPP), "nowhere near the estimated time"|}, (NMP activities)|}|]
[INQUIRES |(Director of NMP), (Alternative storage locations to WIPP)|]
{EQUALS |'time-period-of'(Rumors of WIPP failure to startup), "15 years"|}
{EQUALS |'value-of'(Rumors of WIPP failure to startup), "not important"|}
{EQUALS |'status-of'(All reactors), "shut down"|}
{EQUALS |'status-of',[RESIGNS |(Director of NMP)|], "not true"|}
[INTENDS |[CREATE |(Secretary of Energy), (Special task force for restarting all the reactors)|]|]
[INFORMS |(Director of NMP), (Staff), 'ALL'(Special task force for restarting all the reactors)|]
[INFORMS |(Director of NMP), (Staff), 'plan-for-restart'(All reactors)|]
[MADE |(Someone other than the Director of NMP), (NMP decision)|]
[PUBLISHED |(NMP Division Director), (Report on major, SIS break-throughs)|]
{EQUALS |'accuracy'(Report on major, SIS break-throughs), "inaccurate"|}
{NOIMPACT |(Report on major, SIS break-throughs), (NMP activities)|}
[IFTHEN:ACCELERATE |{EQUALS |'funding-status-of'(SIS), "line-item"|}, (SIS)|]
[IFTHEN:SPECIALCASE |{NOTEQUALS |'funding-status-of'(SIS), "line-item"|}, (SIS)|]
[IFTHEN:ACTS |[INQUIRES |(Director of NMP), (Someone), 'ALL'(SIS)|], (SIS)|]
{EQUALS |'value-of'(SIS), "not useful"|}
{EQUALS |'production-of'(SIS), "no new material"|}

{EQUALS l'raw-materials-used-by'(SIS), "existing material"l}
{EQUALS l'reason-for',{NOIMPACT l(SIS), (NMP activities)l}, "start-up is too far off"l}
{IFTHEN l{EQUALS l'status-of'(All reactors), "considered permanently shutdown"l}, {EQUALS l'value-of'(SIS), "0"l}l}
{EQUALS l'value-of'(Report on major, SIS break-throughs), "not important"l}
{EQUALS l'number-of'(New stockpile cases), "two per week"l}
{EQUALS l'date-of',[BRIEFS l(Someone), (Director of NMP), (New stockpile cases)l], "one day after DAS/MA gets the new stockpile case"l}
[INQUIRES l(Director of NMP), (Someone), {IMPACTOF l(New stockpile cases), (demand for nuclear material)l}l]

B.2 Subject 2

B.2.1 Subject 2, Exercise 1

B.2.1.1 Transcript

From the basic assumptions that I have here, the state of my complex, I already know that I'm vulnerable, if you will. I've already got vulnerabilities to my ability to satisfy material requirements. And what I will presume, in 88 or 89, that this is obviously pre-arms limitations. Therefore the needs that I was previously planning for and this projected shortage of material for the current stockpile case is not likely to be the stockpile case that these discussions could lead to.
One of the things that I'd have a manager do, is look at various scenarios based intelligence we have about these arms limitation talks (in fact it's ongoing now) to take a look at some projected demands and what these might be if we did reduce the requirements. We'd look to see what the new demand or possible demand scenarios might be.
I'd ask for that to be compared to the capabilities that I had at this moment, this point in time, because that would be an interesting data point.
Notwithstanding the fact that, and this one you can hardly deal with, but, some key members of Congress are reportedly pushing to cut DOE's budget by 25%. Now in the real world of today, the arms limitation talks already have people trying to cut budgets. That's the real world. We're always living in a world where we haven't gotten a whole lot of support and we've looked at budget cuts with ever increasing demand. So that's no big deal. So just how much of that is likely to fall on me, I'm not immediately going to worry with. Given that my first responsibility is to provide the material to support the stockpile. I can always make the case that without budget support, production must be cut. So my first and most important thing is to get some possible scenarios to match up.
Now consider this contamination incident at Rocky Flats. The fact that it gets press, these days is not surprising; anything gets out there. We've seen some pretty minor things in the press. So, just because something's in the Washington Post isn't necessarily going to get me upset. But, it does suggest that I want to get some data from the folk who are responsible for Rocky Flats as to the nature of that incident, how serious is that incident, is this indicative of something bigger, what are they going to be

able to support, if you will, what are their needs going to be. Said another way, is this going to change the demand situation, and how. I need that analysis. Is this going to change the demand in some way? Will the near-term demand change? It may change the long-term demand. It may not, over some period of time, change the demand at all. There could be a shift. So, I would want from the staff an assessment of what this Rocky Flats incident might mean to us. It may mean nothing.
And now the last bullet there, that my Deputy has informed me that one of the Savannah River reactors was shut down. Now I've got a serious problem. Now that's the one that has the most immediate implications for me. It presents the most immediate concern for me because I was already headed toward a shortage over 7 years in critical materials. This suggests to me that I must have an assessment of why is that reactor down, how long is that reactor likely to be down, is it a problem that is peculiar to that particular machine, or is it likely to manifest itself in the other two that are operating at Savannah River. Whatever. So, the next thing that I need is an assessment of the reactor. I guess what I'm saying is, for now, I'm faced with this scenario, and the only thing that I'm currently worried about in light of all of this is the reactor and implications on production. These are all nice things to know; and maybe Gorbachev will be killed tomorrow and there will be a build up, not a build down. So, I'm trying to protect what I've got. That's my primary focus. So that right now, of all this good stuff that you've got here, and of all the possible changes in my program, the one that's got my attention is that reactor. I need to have a complete understanding of that, because based on all that you've told me, the reactor is the key to my actions.

B.2.1.2 Translation

The current state of the NMP complex indicates there exist vunerabilities.
These vunerabilities are associated with NMP's ability to meet demand.
From the time period of 1988-1989, the state of the NMP complex is prior to any agreements from arms limitation talks.
The current stockpile case is likely to change.
The Director of NMP would ask a Division Director to run several new supply/demand cases.
The new supply/demand cases should include information about the impact of the arms limitation talks.
When does the new demand reduce the requirements for nuclear materials?
What are the new supply/demand cases?
What is the relationship between new demand cases and NMP's new ability to produce nuclear materials?
Key members of Congress are reportedly pushing to cut DOE's budget by 25%.
The arms limitation talks have caused people to want to cut DOE's budget.
The reason for the budget cut is not waste, fraud, and abuse.
In 1988 and 1989, people have not supported NMP.
NMP has faced increasing demand with budget cuts.
How much of the DOE budget cut would affect NMP?
The potential budget cut is not going to affect NMP activities now.
The Director of NMP must provide the nuclear material called for in the Presidential Stockpile Memorandum.
Not enough budget equals not enough material.
Running new supply/demand cases is the first priority.
The Director of NMP considers the incident of contamination at Rocky Flats.
There may be no impact of this on NMP activities.
The magnitude of some incidents reported is very small and insignificant.
Something reported in the Washington Post is not going to affect NMP's activities.
The Director of NMP inquires of RFP the nature of the problem at RFP.
The Director of NMP inquires of RFP the severity of the problem at RFP.
Is the problem at RFP indicative of a bigger problem at RFP?

How does the problem at RFP impact the demand for nuclear materials?
The Director of NMP needs to know the impact of the problem at RFP on the demand for nuclear materials?
The problem at RFP might impact near-term demand.
The problem at RFP might impact long-term demand.
The problem at RFP might not change the demand over a long period of time.
The problem at RFP might cause a shift in the demand.
The Director of NMP inquires of the staff the impact of the problem at RFP on the supply of nuclear materials.
The problem at RFP might have no impact on demand.
The Deputy Director of NMP informed the Director of NMP about one reactor being shut down.
The reactor being shut down is a serious problem.
Because of the shortfall in 7 years, the reactor being shut down is an immediate problem.
The Director of NMP inquires why the reactor was shut down.
The Director of NMP inquires how long the reactor is likely to be shut down.
The Director of NMP inquires if the nature of the problem is particular to that reactor.
The Director of NMP inquires the affect of the problem on the other SR reactors.
The Director requests an assessment of the reactor being shut down.
Gorbachov could be killed tomorrow resulting in no arms limitation agreements.
There could be an increase in demand instead of a decrease.
The Director of NMP is trying to protect the operating status of NMP facilities.
All the incidents indicate possible changes in NMP activities.
Of all the possible changes in NMP activities, the reactor being shut down is the most important.
The Director of NMP must understand all about the reactor being shut down.
The reactor being shut down represents the only change in NMP activities.
The Director of NMP must provide the material called for in the current Presidential Stockpile Memorandum.

B.2.1.3 Coded Protocol

{IMPLIES I'status-of'(NMP facilities), {EQUALS I'existence-of'(Vunerabilities), "exists"I}I}
{IMPACT I(Vunerabilities), (NMPs ability to meet national security requirements)I}
{DOESNOTINCLUDE I'status-of'(NMP facilities), (U.S.-Soviet agreements)I}
{EQUALS I'change-in'(Current stockpile case), "likely"I}
[RUN I(Director of NMP), (NMP Division Director), (New stockpile cases)I]
{INCLUDE I(New stockpile cases), 'ALL'(Arms limitation talks)I}
[INQUIRES I(Director of NMP), (Someone), 'when',{EQUALS I{IMPACT I(Arms limitation talks), (Demand for nuclear material)I}, "reduction"I}I]
[INQUIRES I(Director of NMP), (Someone), 'ALL'(New stockpile cases)I]
{WHATIS I(New stockpile cases), (NMPs new ability to produce material)I}
[SUPPORT I(Key members of Congress), (Proposal to cut DOEs current budget by 25%)I]
{IMPLIES I(Arms limitation talks), [CUT I(Someone), (DOEs current budget)I]I}
{DOESNOTEQUAL I'reason-for',[CUT I(Someone), (DOEs current budget)I], "to rid the DOE of waste, fraud, and abuse"I}
{EQUALS I'time-period-of',{EQUALS I'support-for-NMP'(Someone), "little"I}, "1988-1989"I}
{EQUALS I'time-period-of',[CUT I(Someone), (DOEs current budget)I], 'time-period-of',{EQUALS I'change-in'(Demand for nuclear material), "increase"I}I}
[INQUIRES I(Director of NMP), (Someone), {IMPACT I[SUPPORT I(Key members of Congress), (Proposal to cut DOEs current budget by 25%)I], (NMPs current budget)I}I]
{EQUALS I'time-period-of',{NOIMPACT I[SUPPORT I(Key members of Congress), (Proposal to cut DOEs current budget by 25%)I], (NMP activities)I}, "near-term"I}
{PROVIDES I(Director of NMP), (Nuclear material called for in the current Presidential Stockpile

Memorandum)|}
{IMPLIES |{EQUALS |'adequacy-of'(NMP budget), "inadequate"|}, {EQUALS |'adequacy-of'(Supply of nuclear material), "inadequate"|}|}
{EQUALS |'priority-of',[SUPPORT |(Key members of Congress), (Proposal to cut DOEs current budget by 25%)|], "first"|}
[CONSIDERS |(Director of NMP), (Article on another incident of contamination at Rocky Flats)|]
{NOIMPACT |(Article on another incident of contamination at Rocky Flats), (NMP activities)|}
{EQUALS |'magnitude-of'(Incidents reported in newspapers), "very small", AND "insignificant"|}
{NOIMPACT |(Incidents reported in newspapers), (NMP activities)|}
[INQUIRES |(Director of NMP), (RFP), 'nature-of-problem'(Contamination at RFP)|]
[INQUIRES |(Director of NMP), (RFP), 'severity-of-problem'(Contamination at RFP)|]
[INQUIRES |(Director of NMP), (RFP), {IMPLIES |'nature-of-problem'(Contamination at RFP), (Bigger problem at RFP)|}|]
[INQUIRES |(Director of NMP), (RFP), 'ALL',{IMPACT |(Contamination at RFP), (Demand for nuclear material)|}|]
[NEEDS |(Director of NMP), [UNDERSTAND |(Director of NMP), 'ALL',{IMPACT |(Contamination at RFP), (Demand for nuclear material)|}|]|]
{EQUALS |'time-period-of',{IMPACT |(Contamination at RFP), (Demand for nuclear material)|}, "near-term"|}
{EQUALS |'time-period-of',{IMPACT |(Contamination at RFP), (Demand for nuclear material)|}, "long-term"|}
{EQUALS |'time-period-of',{NOIMPACT |(Contamination at RFP), (Demand for nuclear material)|}, "long-term"|}
{EQUALS |'magnitude-of',{IMPACT |(Contamination at RFP), (Demand for nuclear material)|}, "shift in demand"|}
[INQUIRES |(Director of NMP), (Staff), 'ALL',{IMPACT |(Contamination at RFP), (Supply of nuclear material)|}|]
{NOIMPACT |(Contamination at RFP), (Demand for nuclear material)|}
[INFORMS |(Deputy Director of NMP), (Director of NMP), (Reactor was shut down)|]
{EQUALS |'severity-of'(Reactor was shut down), "severe"|}
{IMPLIES |{EQUALS |'crossover-for-tritium-of'(Current stockpile case), "seven years"|}, AND {EQUALS |'crossover-for-plutonium-of'(Current stockpile case), "seven years"|}, {EQUALS |'severity-of'(Reactor was shut down), "severe"|}|}
[INQUIRES |(Director of NMP), (Someone), 'reason-for'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), 'anticipated-down-time'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'nature-of-problem'(Reactor was shut down), "particular to that reactor"|}|]
[INQUIRES |(Director of NMP), (Someone), {IMPACT |(Reactor was shut down), (All reactors)|}|]
[DIRECTS |(Director of NMP), (Someone), [ASSESS |(Someone), (Reactor was shut down)|]|]
{IMPLIES |{EQUALS |'date-of',[KILL |(Someone), (Gorbachov)|], "tomorrow"|}, {EQUALS |'existence-of'(U.S.-Soviet agreements), "dont exist"|}|}
{IMPLIES |{EQUALS |'date-of',[KILL |(Someone), (Gorbachov)|], "tomorrow"|}, {EQUALS |'change-in'(Demand for nuclear material), "increase"|}|}
[PROTECT |(Director of NMP), 'status-of'(NMP facilities)|]
{IMPLIES |(Incidents in the scenario), {EQUALS |'change-in'(NMP activities), "likely"|}|}
{EQUALS |'severity-of'(Reactor was shut down), "most important"|}
[UNDERSTAND |(Director of NMP), 'ALL'(Reactor was shut down)|]
{IMPLIES |(Reactor was shut down), 'change-in'(NMP activities)|}
[PROVIDES |(Director of NMP), (Nuclear material called for in the current Presidential Stockpile Memorandum)|]

B.2.2 Subject 2, Exercise 2

B.2.2.1 Transcript

Okay. Do you want to pick up overall? With regard to the scenario, before we get to the exercise. When I'd read the exercise, the overall scenario to begin with, I presumed that with the two reactors at 100% and the one reactor at 50%, that, and the projected tritium and plutonium shortfall for the current stockpile case, I presumed that we already had under way analyses to (a) do whatever we could to get more plutonium from residues and from scrap, and that we already had underway initiatives to find other ways to get plutonium into the system. We would have done that via the respective program managers within NMP. Then utilizing those folk and the resources of the field to do those analyses as to what could be done, to come up with various ways to get more material into the system. For plutonium, that's easier. For tritium, the only sources are the new material coming from the reactors and then what you can recycle from weapons that you are retiring, or the LLC's that are coming back, the limited life components.

So now we'll look at exercise 2.

With regard to point 1,Gorbachev and President Bush have agreed to reduce the number of nuclear weapons in Europe. That's fine. One of the first things I'd like an analysis of is to get some G-2 on what is that number? Do we know? Do we know which weapons systems? And there is a matter of assigning the appropriate manager to work with his counterparts in the Office of the DAS, Military Applications, to take a look and see what this might mean. And at that time, I would have the production planning people run the analyses to see what impact there would be on supply/demand opposite the numbers being projected. And that's fine. Because that would give you an opportunity to see if, based on that treaty, which is not ratified now, if these requirements are going to reduce ultimately, which materials you could find depending upon what you were going to do. There'd be a change in mix of materials. So you've got to understand that too. But that's what I'd have. I'd have the analyses to see what is the impact on the materials.

Ah, the FBI agents seized the Rocky Flats Plant and secured all files. That suggests that we have a serious problem at Rocky Flats. And from that point of view, that plant is not mine to worry with, but just as in exercise 1, again, I want to stay closely coupled with Military Applications, because now I want the staff to stay closely tied in with them to keep track of what impact that's going to have on the ability to build new weapons and what impact that's going to have on the ability to receive material from Savannah River. What is the change in demand and over what time period? And just what is the impact of that seizure? Has it shut the plant down? What has it done to the plant? So, for now, I have an immediate need, if it means immediately that I've got to stop shipping material to Rocky, or alternatively they're immediately going to stop shipping to me things like the limited life components, the new ones that need filling for, say, new weapons. I need to understand that. I need that data. I need that data analyzed. So I need to understand what impact that's going to have on my facilities and my program.

K-reactor is down with problems. As in exercise 1, I must understand what are those problems. Are they fixable? What is the prognosis? How long is it going to take? How soon is the reactor going to come back? What is it's impact? (It says shut down with problems.) What is this going to do the schedule? What is it going to do? That's important. P-reactor and L-reactor still operating normally. And that tells me that what I was getting out of those two, at least for the time being, that's what I'm going to continue to get.

And the last point, you just found out the Washington Post has run the article stating they have an internal DOE contractor memo stating the safety analyses performed on the reactors when they were designed is inadequate by today's standards. That is one that I would immediately start to run down. I'd have the program people in charge of the reactors reviewing the safety analyses. I'd like to see what it is they're referring to. Here is a case where you need to interact with your own people. Do they have a case or not? Who wrote the internal memo? Was it, is it, valid or not? But you'd be doing damage control. You'd be saying is this valid or is this not valid. You would be soliciting the assistance of other elements from within the department and from Los Alamos who provides us support.

B.2.2.2 Translation

The status of the NMP complex implies the Director of NMP would direct his staff to provide alternatives for the supply of nuclear material.
The alternatives would include obtaining more plutonium from scrap.
The alternatives would include other ways to get more plutonium into the supply of nuclear material.
The status of the NMP complex implies the Director of NMP would direct his staff to provide alternatives for the supply of nuclear material.
Finding alternative sources of plutonium is easier than finding alternative sources of tritium.
The alternative sources of tritium are reactors and recycled weapons.
There exists an agreement to reduce the number of nuclear weapons in Europe.
The agreement is between Gorbachov and President Bush.
The Director of NMP inquires the number of weapons cut.
The Director of NMP inquires what weapons were cut.
The Director of NMP directs an NMP Division Director to work with DAS/MA Division Director to determine the impact of U.S.-Soviet agreements.
The Director of NMP directs the NMP Planning Group to run supply/demand cases with the U.S.-Soviet agreements.
The Director of NMP inquires of the NMP Planning Group what impact the U.S.-Soviet agreement has on the current supply/demand.
The U.S.-Soviet agreement is not ratified by Congress.
The Director of NMP inquires if the impact of the agreements reduce the demand for nuclear material.
The weapons cut implies a change in the mix of nuclear material required.
The Director of NMP must understand the change in the mix of nuclear material required.
The Director of NMP directs the NMP Planning Group to run supply/demand cases with the U.S.-Soviet agreements.
The FBI seized the Rocky Flats Plant.
The FBI secured all the files at the Rocky Flats Plant.
The FBI seizing and securing RFP implies the problems at RFP are serious.
NMP does not own RFP.
The Director of NMP maintains contact with DAS/MA.
The Director of NMP inquires of staff the impact of the problems at RFP on RFP's ability to build new weapons.
The Director of NMP inquires of staff the impact of problems at RFP on RFP's ability to recieve material from SR.
The Director of NMP inquires of staff the change in demand for nuclear materials.
The Director of NMP inquires of staff the time period of the change in demand for nuclear materials.
The Director of NMP inquires of staff all about the impact of the problems at RFP on NMP activities.
The Director of NMP inquires if the RFP is shut down.
The Director of NMP inquires all about the problem at RFP.

The problems at RFP could mean the Director of NMP stops shipping nuclear material from SR to RFP.
The problems at RFP could mean OMA stops shipping LLCs from RFP to SR.
The Director of NMP must understand the impact of the problems at RFP on NMP activities.
The Director of NMP needs all the information about the problems at RFP.
The Director of NMP needs all the information about the impacts of the problems at RFP on NMP activities.
The Director of NMP must understand all about the impacts of the problems at RFP on NMP activities.
K-reactor is down with problems.
The Director of NMP must understand all about K-reactor being down with problems.
The Director of NMP inquires if a problem solution for K-reactor's problems exists.
The Director of NMP inquires the nature of the problem with K-reactor.
The Director of NMP inquires the plan for restart of K-reactor.
The Director of NMP inquires the plan for restart of K-reactor.
The Director of NMP inquires the impact of the problems with K-reactor on NMP activities.
The Director of NMP inquires the impact of the problems with K-reactor on the supply of nuclear materials.
The Director of NMP inquires the impact of the problems with K-reactor on the supply of nuclear materials.
It is important for the Director of NMP to have the information about the impact of the problems with K-reactor on the supply of nuclear material.
The status of P-reactor is normal.
The status of L-reactor is normal.
The production of the NMP complex is equal to the production of P-reactor and L-reactor.
The Washington Post published an article on an internal DOE contractor memo about safety analyses.
The Director inquires of someone about the article on safety analyses immediately.
The Director of NMP directs the Director of the Reactor Division to review the safety analyses.
The Director of NMP asks for a copy of the internal DOE contractor memo on safety analyses.
The Director of NMP works with his staff.
The Director of NMP validates if the safety analyses are inadequate.
The Director of NMP inquires of someone who wrote the internal DOE contractor memo on safety analyses.
The Director of NMP validates if the safety analyses are inadequate.
The Director of NMP executes damage control about the article on the internal DOE contractor memo on safety analyses.
The Director of NMP validates if the safety analyses are inadequate.
The Director of NMP requests assistance from other DOE organizations.
The Director of NMP requests assistance from Los Alamos National Laboratories.

B.2.2.3 Coded Protocol

{IMPLIES I'status-of'(NMP facilities), [DIRECTS I(Director of NMP), (Staff), [PROVIDE I(Staff), (Alternative supplies of nuclear material)I]I]I}
{INCLUDE I(Alternative supplies of plutonium), (Accelerated plutonium scrap processing)I}
{INCLUDEOTHERTHAN I(Alternative supplies of plutonium), (Accelerated plutonium scrap processing)I}
{IMPLIES I'status-of'(NMP facilities), [DIRECTS I(Director of NMP), (Staff), [PROVIDE I(Staff), (Alternative supplies of nuclear material)I]I]I}
{EASIERTHAN I[FINDS I(Someone), (Alternative supplies of plutonium)I], [FINDS I(Someone), (Alternative supplies of tritium)I]I}
{EQUALS I(Alternative supplies of tritium), (Reactor production of tritium), AND (Tritium recycle from retired weapons)I}
{EQUALS I'existence-of'(Agreement to reduce the number of nuclear weapons in Europe), "exists"I}
{EQUALS I'parties-in-agreement'(Agreement to reduce the number of nuclear weapons in Europe), "President Bush", AND "Gorbachov"I}

[INQUIRES |(Director of NMP), (Someone), 'number-of'(Weapons cut)|]
[INQUIRES |(Director of NMP), (Someone), 'what'(Weapons cut)|]
[DIRECTS |(Director of NMP), (Staff), [WORKWITH |(Staff), (DAS/MA Staff), [DETERMINE |(Staff), {IMPACT |(U.S.-Soviet agreements), (NMP activities)|}|]|]|]
[DIRECTS |(Director of NMP), (Planning Division Director), [PREPARE |(Staff), {INCLUDES |(New supply/demand cases), (U.S.-Soviet agreements)|}|]|]
[INQUIRES |(Director of NMP), (Planning Division Director), {IMPACT |(U.S.-Soviet agreements), (Current supply/demand cases)|}|]
{EQUALS |'status-of'(U.S.-Soviet agreements), "not ratified by Congress"|}
[INQUIRES |(Director of NMP), (Someone), {EQUALS |{IMPACT |(U.S.-Soviet agreements), (Demand for nuclear material)|}, "reduce demand"|}|]
{IMPLIES |(Weapons cut), 'change-in'(Mix of nuclear material required)|}
[UNDERSTAND |(Director of NMP), 'change-in'(Mix of nuclear material required)|]
[DIRECTS |(Director of NMP), (Planning Division Director), [PREPARE |(Staff), {INCLUDES |(New supply/demand cases), (U.S.-Soviet agreements)|}|]|]
[SEIZED |(FBI), (RFP)|]
[SECURED |(FBI), 'files-of'(RFP)|]
{IMPLIES |[SEIZED |(FBI), (RFP)|], AND [SECURED |(FBI), 'files-of'(RFP)|], {EQUALS |'nature-of-problem'(RFP), "severe"|}|}
{DOESNOTOWN |(NMP), (RFP)|}
[MAINTAINSCONTACT |(Director of NMP), (DAS/MA), 'status-of'(RFP)|]
[INQUIRES |(Director of NMP), (Staff), {IMPACT |'nature-of-problem'(RFP), 'production-of'(RFP)|}|]
[INQUIRES |(Director of NMP), (Staff), {IMPACT |'nature-of-problem'(RFP), 'ability-to-receive-shipments'(RFP)|}|]
[INQUIRES |(Director of NMP), (Staff), {IMPACT |'nature-of-problem'(RFP), (Demand for nuclear material)|}|]
[INQUIRES |(Director of NMP), (Staff), 'time-period-of',{IMPACT |'nature-of-problem'(RFP), (Demand for nuclear material)|}|]
[INQUIRES |(Director of NMP), (Staff), 'ALL',{IMPACT |'nature-of-problem'(RFP), (NMP activities)|}|]
[INQUIRES |(Director of NMP), (Staff), {EQUALS |'status-of'(RFP), "shut down"|}|]
[INQUIRES |(Director of NMP), (Staff), 'ALL'(RFP)|]
{IMPLIES |'nature-of-problem'(RFP), [STOPSHIPMENTS |(Director of NMP), (SR), (RFP), (Plutonium), AND (Tritium)|]|}
{IMPLIES |'nature-of-problem'(RFP), [STOPSHIPMENTS |(DAS/MA), (RFP), (SR), (LLCs)|]|}
[UNDERSTAND |(Director of NMP), 'ALL', {IMPACT |'nature-of-problem'(RFP), (NMP activities)|}|]
[INQUIRES |(Director of NMP), 'ALL'(RFP)|]
[INQUIRES |(Director of NMP), 'ALL', {IMPACT |'nature-of-problem'(RFP), (NMP activities)|}|]
[UNDERSTAND |(Director of NMP), 'ALL', {IMPACT |'nature-of-problem'(RFP), (NMP activities)|}|]
{EQUALS |'status-of'(K-reactor), "down with problems"|}
[UNDERSTAND |(Director of NMP), 'ALL',{EQUALS |'status-of'(K-reactor), "down with problems"|}|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'problem-solution-for',{EQUALS |'status-of'(K-reactor), "down with problems"|}, "exists"|}|]
[INQUIRES |(Director of NMP), (Someone), 'nature-of-problem',{EQUALS |'status-of'(K-reactor), "down with problems"|}|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for-restart'(K-reactor)|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for-restart'(K-reactor)|]
[INQUIRES |(Director of NMP), (Someone), {IMPACT |{EQUALS |'status-of'(K-reactor), "down with problems"|}, (NMP activities)|}|]
[INQUIRES |(Director of NMP), (Someone), {IMPACT |{EQUALS |'status-of'(K-reactor), "down with problems"|}, (Supply of nuclear material)|}|]
[INQUIRES |(Director of NMP), (Someone), {IMPACT |{EQUALS |'status-of'(K-reactor), "down with

problems"|}, (Supply of nuclear material)|}|]
{EQUALS |'value-of',[INQUIRES |(Director of NMP), (Someone), {IMPACT |{EQUALS |'status-of'(K-reactor), "down with problems"|}, (Supply of nuclear material)|}|], "important"|}
{EQUALS |'status-of'(P-reactor), "normal"|}
{EQUALS |'status-of'(L-reactor), "normal"|}
{EQUALS |'production-of'(NMP facilities), [SUMOF |'production-of'(P-reactor), 'production-of'(L-reactor)|]|}
[PUBLISHED |(The Washington Post), (Article on an internal DOE contractor memo about safety analyses)|]
{EQUALS |'date-of',[INQUIRES |(Director of NMP), (Someone), 'ALL'(Article on an internal DOE contractor memo about safety analyses)|], "immediately"|}
[DIRECTS |(Director of NMP), (Reactor Division Director), [REVIEW |(Reactor Division Director), (Reactor safety analyses)|]|]
[REQUESTSCOPY |(Director of NMP), (Someone), (Internal DOE contractor memo about safety analyses)|]
[WORKSWITH |(Director of NMP), (Staff)|]
[VALIDATES |(Director of NMP), 'adequacy-of'(Reactor safety analyses)|]
[INQUIRES |(Director of NMP), (Someone), 'author-of'(Internal DOE contractor memo about safety analyses)|]
[VALIDATES |(Director of NMP), 'adequacy-of'(Reactor safety analyses)|]
[DAMAGECONTROL |(Director of NMP), [PUBLISHED |(The Washington Post), (Article on an internal DOE contractor memo about safety analyses)|]|]
[VALIDATES |(Director of NMP), 'adequacy-of'(Reactor safety analyses)|]
[REQUESTSASSISTANCE |(Director of NMP), (Other DOE organizations)|]
[REQUESTSASSISTANCE |(Director of NMP), (LLNL), (Reactor safety analyses)|]

B.2.3 Subject 2, Exercise 3

B.2.3.1 Transcript

I think because of all this, I'm going to go down them a bullet at a time. The first one. The governor of Ohio has just stopped all shipments of nuclear materials through the state until FMPC is cleaned up. What's left out of this, and it almost needs to be an assumption, I think it's a proper one, we're not making any new plutonium. Consequently, at Fernald, we are not making any targets for any of our reactors for the materials in question. As it turns out even today, (this did say 88 and 89) this problem would have a potential impact for the supply of depleted uranium for the weapons program, DAS/MA. I'm responsible for providing that depleted uranium. So from that point of view I would have not been able to ship, unless we had it already pre-shipped, and you could have had that situation. I don't know because this isn't that explicit. What I have effectively done is cut off the depleted uranium shipments to Oak Ridge. Now the realities of today are that we are looking to get out of Fernald; we're looking for commercial vendors to supply depleted uranium. So if this were today, my reaction to the first one would be sort of ho-hum, because they're not making anything anyway. They haven't made anything now, and part of this time they've already been down, 89. In fact, we, working in conjunction with the DAS for Military Application, totally in conjunction with him, are already seeking the alternate supply of materials for Y-12. That's the way the real world has worked.
I'll give you that much because that's sort of how it is, but if you want me to force it back to this other thing, that's another matter. But in 89 they weren't operating.

So, that would be sort of a ho-hummer because right now the Department is really looking to get out of Fernald. There will be no production mission. There will be a clean-up mission. So you could care less about that. (Unless of course the vendor qualification program goes belly-up.) Then Fernald would be the only place you could go to get it. So, right now that first one would be a ho-hummer. It's where we are today. So big deal!

Last week there was a leak from one of the tanks at Fernald. Now that's a problem to us, to be sure. Not withstanding the fact that it's not doing anything for your relationship in Ohio! That's a problem because you've got a potential impact on workers, you've got environmental impacts. So there you need the whole host of information on that; the nature of the leak, what was the material, where's it leaking to, has the leak been plugged, is it a serious problem, what was, the whole host of things that surround a leaking tank. And that's not withstanding that you're not making a thing at Fernald. You'd want to know all those things.

All the reactors are down at SR is a serious problem. That's the scenario. If all the reactors are down, you're going to be one busy person right now, and we are. Because you are in the mode of understanding why the reactors are down. Of course if you look today, the real world, you're down but you're taking all the steps necessary to satisfy everybody that needs to be satisfied, that they are safe to operate, that they are ready to operate, that you're upgrading the conduct of operations, you're doing all those things. So, the fact that all the reactors are down at SR requires that you do something to get them up based on this. And in fact the Department's doing that. So as the Director, you'd be working like hell to make that a reality. And all holes, all stops would have been pulled, as they are.

You just returned from Forrestal where you heard rumors of a reorganization because of all the problems with the production complexes. Funny. Maybe I am be unique, but that kind of stuff doesn't typically bother me. That might be frightening, but things like that don't bother me. And I mean that. Now I'd come back and I might feel bad if I felt like the reorganization was because of me. So, there's one worry. You know you'd do some G-2, but you're not likely to do that through staff. What is the problem? What is the nature of the problem? Or if you just heard that there was going to be such a thing and you had a full explanation, well that does say rumors. And rumors are that. And that one probably ought to be left there, alone. Maybe you do a little more G-2, and maybe you'd look more closely, perhaps a little introspective look at yourself and say, you know, what are the problems, maybe I am the problem. Maybe I have been making poor decisions and I need to go someplace else. But that as such wouldn't give me any great fits.

In a meeting at the Forrestal the DAS for Military Applications expressed displeasure with you for not being able to produce enough material to meet peg points. And I guess there maybe he'd be right and maybe he wouldn't and it would have depended on the nature of the meeting. And that one's not all that explicit, you might have been defensive as to what you did--Hey I'm doing all that I can do. You might have said I need some more help. You might have been in that mode. Hey I've done everything but I still need assistance. You might have gone into that mode of identifying what else needed to be done. And in fact from that point of view, you'd have to evaluate what he said and then come back and see if you were doing everything. That's how I'd read through those bullets.

What are you going to tell managers to do and how will this affect NMP's normal operating strategies? The first one, you'd get the appropriate program manager and let him know what happened. Let him assess what that was going to do to the program. And as I say in the scenario, it'd be nothing. But what is this going to mean. Also what is "cleaned up?" You'd need to do a complete disection of that first one to even know what that impact was. Not very real in today's world, but you'd really have to know is there something specific, he wants a particular thing taken care of that you can produce. You'd have to do the whole exploration around that. What does he want cleaned up, how much, what is the thing? What can I do? Do I need to move some resources to do it? How critical is the material? I'd have to do all that.

Last week there was a leak at one of the tanks. If the leak was last week and I'm only finding about it today, I've got some other problems. But on the other hand there's one you want to understand the nature of and everything else. Was it properly reported? You're the line program manager, so you'd do all the G-2 around that.
All the reactors are down. I think I've just talked through that one.
You just returned from Forrestal, the rumor, and I think I've talked through that one. Rumors are that. And other than the fact that I might start thinking that, Gee, if that's going to happen, I'd do an introspective but I wouldn't do more than that.
And the DAS, now the last one is the one that, I guess bullets 2, 3, and this 5th one are ones of most interest to me. And this last one, I would assess what he said. I'd assess what I said, in response. What did he say? Were there some specifics? If there were some specific problems, if he had some, if it wasn't just you son-of-a-gun, you're not supporting me, you would deal with the specifics. If it was this couldn't happen because the deliveries were late or you're not making the peg point and you look at it and you find that it's something in your system that's wrong then you're going to go back and you're going find out why, who did it, why didn't it get done, etc. And get on with it.

B.2.3.2 Translation

The governor of Ohio stopped shipments of nuclear materials through the state of Ohio.
The governor's actions will last until FMPC is cleaned up.
NMP is not producing any new plutonium.
Consequently, FMPC is not producing any targets for the reactors.
The impact of the governor's actions would be to cut off the supply of depleted uranium to the weapons complex.
The Director of NMP provides depleted uranium to DAS/MA.
The impact of the governor's actions would be the Director of NMP could not ship depleted uranium to DAS/MA.
FMPC could have pre-shipped depleted uranium to Oak Ridge.
The impact of the governor's actions would be to cut off the supply of depleted uranium to Oak Ridge.
The DOE is looking for commercial vendors to supply depleted uranium.
The reason for looking for commercial vendors to supply depleted uranium is to close FMPC.
If the governor of Ohio stopped shipments today, the response of the Director of NMP would be minimal.
The reason the Director of NMP's response would be minimal is because the status of FMPC is not producing anything.
The time period of FMPC not producing anything includes 1989.
Working with the DAS/MA, the Director of NMP is looking for alternative supplies of depleted uranium for Y-12.
The time period of FMPC not producing anything includes 1989.
The reason the Director of NMP's response would be minimal is because the status of FMPC is not producing anything.
The reason for looking for commercial vendors to supply depleted uranium is to close FMPC.
The mission at FMPC will equal no production.
The mission at FMPC will equal clean-up.
The reason the Director of NMP's response would be minimal is because the mission at FMPC will equal no production.
If the result of the looking for commercial vendors to supply depleted uranium is no vendors, then FMPC is the only source of depeleted uranium.
For the current time period, the Director of NMP's response would be minimal.
The leak from one of the tanks at FMPC occurred last week.

The leak from one of the tanks at FMPC is a problem.
The leak from one of the tanks at FMPC has a negative impact on the relationship of DOE with the Governor of Ohio.
The leak from one of the tanks at FMPC potentially impacts workers.
The leak from one of the tanks at FMPC potentially impacts on the environment.
The Director of NMP inquires all about the leak from one of the tanks at FMPC.
The Director of NMP inquires of someone the nature of the leak from one of the tanks at FMPC.
The Director of NMP inquires of someone what material leaked from one of the tanks at FMPC.
The Director of NMP inquires of someone the flow pattern of the material leaked from one of the tanks at FMPC.
The Director of NMP inquires of someone if the status of the leak from one of the tanks at FMPC equals leaked stopped.
The Director of NMP inquires of someone if the severity of the leak from one of the tanks at FMPC is severe.
The Director of NMP inquires all about the leak from one of the tanks at FMPC.
FMPC is not producing any targets for the reactors.
The Director of NMP inquires all about the leak from one of the tanks at FMPC.
The status of all the reactors equals shut down.
The severity of all the reactors being shut down is serious.
The Director of NMP must understand why all the reactors are shut down.
The Director of NMP must satisfy everyone concerned with the reactors.
The Director of NMP must provide information that the reactors are safe to operate.
The Director of NMP must provide information that the reactors are ready to operate.
The Director of NMP must provide information that the Director of NMP is upgrading the conduct of operations of the reactors.
The Director of NMP must provide information about NMP activities.
The Director of NMP would have a plan for restarting all the reactors.
The Director of NMP would be executing the plan for restarting all the reactors.
The execution of the plan for restarting all the reactors would be first priority.
The Director of NMP just returned from Forrestal.
The Director of NMP was informed by someone of plans for a reorganization of DOE.
The reason for the plans for reorganization is problems with the production complexes.
The Director of NMP's response to the rumors of reorganization would be minimal.
If the cause of the reoraginzation was the Director of NMP, then the Director of NMP might feel bad.
The Director of NMP inquires from someone other than Staff all about the plans for reorganization.
The Director of NMP inquires from someone other than Staff what is the problem that caused the plans for reorganization.
The Director of NMP inquires from someone other than Staff the nature of the problem that caused the plans for reorganization.
Rumors are rumors.
The Director of NMP does not inquire all about the plans for reorganization.
The Director of NMP inquires all about the plans for reorganization.
The problem causing the plans for reorganization is the Director of NMP.
The Director of NMP has made poor decisions.
The Director of NMP needs to change jobs.
The Director of NMP would not be concerned about the plans for reorganization.
The DAS/MA expressed displeasure with the Director of NMP.
The reason for the DAS/MA expressing displeasure was not being able to produce enough material to meet peg points.
The DAS/MA expressing displeasure occurred today in a meeting.
The statements of the DAS/MA might be true.
The statements of the DAS/MA might not be true.

The truth of the statements of the DAS/MA depends on the nature of the meeting.
The Director of NMP might be defensive.
The Director of NMP might have needed more help.
The Director of NMP might have identified additional work to be done.
The Director of NMP evaluates the statements of the DAS/MA.
Based on the evaluation of the DAS/MA's statements, the Director of NMP reconsiders NMP activities.
The Director of NMP informs a Division Director of the Governor of Ohio stopping all shipments through the state.
The Division Director determines the impact of the governor's actions on NMP activities.
The governor's actions would have no impact on NMP activities.
The Director of NMP inquires of the Division Director all about the impact of the governor's actions on NMP activities.
The Director of NMP inquires of the Division Director the governor's meaning of cleaned up.
The Director of NMP inquires of the Division Director all about the impact of the governor's actions on NMP activities.
The Director of NMP inquires of the Division Director does the meaning of cleaned up equal something specific.
The Director of NMP inquires of the Division Director does the meaning of cleaned up equal a particular thing taken care of.
The Director of NMP inquires of the Division Director is the particular thing taken care of something that NMP can provide.
The Director of NMP inquires of the Division Director the governor's meaning of cleaned up.
The Director of NMP inquires of the Division Director if the Director of NMP needs to move resources.
The Director of NMP inquires of the Division Director the importance of the material from FMPC.
Last week there was a leak from one of the tanks at FMPC.
If the date of the leak was last week and the date of the Director of NMP being informed is today then other problems exist.
The Director of NMP must understand the nature of the leak in one of the tanks at FMPC.
The Director of NMP must understand all about the leak in one of the tanks at FMPC.
The Director of NMP inquires of someone if the reporting of the leak in one of the tanks at FMPC was proper.
The Director of NMP inquires of the Division Director all about the leak in one of the tanks at FMPC.
The status of all reactors is shut down.
The Director of NMP was informed by someone of plans for a reorganization of DOE.
Rumors are rumors.
The Director of NMP considers the plans for reorganization.
The Director of NMP evaluates the statements of the DAS/MA.
The Director of NMP looks for problems in NMP activities.

B.2.3.3 Coded Protocol

[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]
{EQUALS |'time-period-of',[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], "until FMPC is cleaned up"|}
{EQUALS |'production-of'(NMP facilities), "no new plutonium"|}
{IMPACTS |{EQUALS |'production-of'(NMP facilities), "no new plutonium"|}, {EQUALS |'production-of'(FMPC), "no reactor targets"|}|}
{IMPACT |(Governor of Ohios actions), [STOPPED |(Governor of Ohio), [SHIPPING |(FMPC), (Weapons complex), (Depleted uranium)|]|]|}
[PROVIDES |(Director of NMP), (DAS/MA), (Depleted uranium)|]

{IMPACT |(Governor of Ohios actions), [STOPPED |(Governor of Ohio), [SHIPPING |(Director of NMP), (DAS/MA), (Depleted uranium)|]|]|}
[PRESHIPPED |(FMPC), (OR), (Depleted uranium)|]
{IMPACT |(Governor of Ohios actions), [STOPPED |(Governor of Ohio), [SHIPPING |(FMPC), (OR), (Depleted uranium)|]|]|}
[SOLICITING |(DOE), (Commercial vendors), [PROVIDE |(Commercial vendors), (DOE), (Depleted uranium)|]|]
{EQUALS |'reason-for',[SOLICITING |(DOE), (Commercial vendors), [PROVIDE |(Commercial vendors), (DOE), (Depleted uranium)|]|], "Close FMPC"|}
[REACTION |(Director of NMP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], "minimal"|]
{EQUALS |'reason-for', [REACTION |(Director of NMP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], "minimal"|], {EQUALS |'production-of'(FMPC), "no reactor targets"|}|}
{EQUALS |'time-period-of',{EQUALS |'production-of'(FMPC), "no reactor targets"|}, "1989"|}
[WORKSWITH |(Director of NMP), (DAS/MA), [SOLICITING |(DOE), (Commercial vendors), [PROVIDE |(Commercial vendors), (Y-12), (Depleted uranium)|]|]|]
{EQUALS |'time-period-of',{EQUALS |'production-of'(FMPC), "no reactor targets"|}, "1989"|}
{EQUALS |'reason-for', [REACTION |(Director of NMP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], "minimal"|], {EQUALS |'production-of'(FMPC), "no reactor targets"|}|}
{EQUALS |'reason-for',[SOLICITING |(DOE), (Commercial vendors), [PROVIDE |(Commercial vendors), (DOE), (Depleted uranium)|]|], "Close FMPC"|}
{WILLEQUAL |'mission-of'(FMPC), "no production"|}
{WILLEQUAL |'mission-of'(FMPC), "clean-up"|}
{EQUALS |'reason-for', [REACTION |(Director of NMP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], "minimal"|],{WILLEQUAL |'mission-of'(FMPC), "no production"|}|}
{IFTHEN |{EQUALS |'outcome-of', [SOLICITING |(DOE), (Commercial vendors), [PROVIDE |(Commercial vendors), (DOE), (Depleted uranium)|]|], "no vendors"|}, {EQUALS |(FMPC), (Sole supplier of depleted uranium)|}|}
{EQUALS |'time-period-of', [REACTION |(Director of NMP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], "minimal"|], "for now"|}
{EQUALS |'date-of'(Leak from one of the tanks at FMPC), "last week"|}
{EQUALS |(Leak from one of the tanks at FMPC), (Problem)|}
{NEGATIVEIMPACT |(Leak from one of the tanks at FMPC), {RELATIONSHIPOF |(DOE), (Governor of Ohio)|}|}
{POTENTIALNEGATIVEIMPACT |(Leak from one of the tanks at FMPC), (FMPC workers)|}
{POTENTIALNEGATIVEIMPACT |(Leak from one of the tanks at FMPC), (Environment)|}
[INQUIRES |(Director of NMP), (Someone), 'ALL'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'nature-of'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'what-material'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'flow-of-material'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'status-of'(Leak from one of the tanks at FMPC), "leak stopped"|}|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'severity-of'(Leak from one of the tanks at FMPC), "severe"|}|]
[INQUIRES |(Director of NMP), (Someone), 'ALL'(Leak from one of the tanks at FMPC)|]
{EQUALS |'production-of'(FMPC), "no reactor targets"|}
[INQUIRES |(Director of NMP), (Someone), 'ALL'(Leak from one of the tanks at FMPC)|]
{EQUALS |'status-of'(All reactors), "shut down"|}

{EQUALS |'severity-of',{EQUALS |'status-of'(All reactors), "shut down"|}, "serious"|}
[UNDERSTAND |(Director of NMP), 'why',{EQUALS |'status-of'(All reactors), "shut down"|}|]
[PROVIDE |(Director of NMP), (Everyone), (Answers to questions about the reactors)|]
[PROVIDE |(Director of NMP), (Everyone), 'information-about',{EQUALS |'status-of'(All reactors), "safe to operate"|}|]
[PROVIDE |(Director of NMP), (Everyone), 'information-about',{EQUALS |'status-of'(All reactors), "ready to operate"|}|]
[PROVIDE |(Director of NMP), (Everyone), 'information-about',[UPGRADING |(Director of NMP), (Conduct of operations of the reactors)|]|]
[PROVIDE |(Director of NMP), (Everyone), 'information-about'(NMP activities)|]
{OWN |(Director of NMP), (Plan for restarting the reactors)|}
[ACTION |(Director of NMP), (Plan for restarting the reactors)|]
{EQUALS |'priority-of',[ACTION |(Director of NMP), (Plan for restarting the reactors)|], "first"|}
[RETURNEDFROM |(Director of NMP), (Forrestal)|]
[INFORMS |(Someone), (Director of NMP), (Plans for reorganization of DOE)|]
{EQUALS |'reason-for'(Plans for reorganization of DOE), "problems with the production complexes"|}
[REACTION |(Director of NMP), (Plans for reorganization of DOE), "minimal"|]
{IFTHEN |{EQUALS |'reason-for'(Plans for reorganization of DOE), (Director of NMP)|}, {EQUALS |'feelings-of'(Director of NMP), "bad"|}|}
[INQUIRES |(Director of NMP), (Someone other than staff), 'ALL'(Plans for reorganization of DOE)|]
[INQUIRES |(Director of NMP), (Someone other than staff), 'reason-for'(Plans for reorganization of DOE)|]
[INQUIRES |(Director of NMP), (Someone other than staff), 'nature-of-reason-for'(Plans for reorganization of DOE)|]
{EQUALS |(Rumors), (Rumors)|}
[DOESNOTINQUIRE |(Director of NMP), (Someone other than staff), 'ALL'(Plans for reorganization of DOE)|]
[INQUIRES |(Director of NMP), (Someone other than staff), 'ALL'(Plans for reorganization of DOE)|]
{EQUALS |'reason-for'(Plans for reorganization of DOE), (Director of NMP)|}
{EQUALS |'quality-of',[DECIDES |(Director of NMP),(Something)|], "poor"|}
[CHANGEJOBS |(Director of NMP)|]
[REACTION |(Director of NMP), (Plans for reorganization of DOE), "minimal"|]
[EXPRESSEDDISPLEASURE |(DAS/MA), (Director of NMP)|]
{EQUALS |'reason-for',[EXPRESSEDDISPLEASURE |(DAS/MA), (Director of NMP)|], "not being able to produce enough material to meet peg points"|}
{EQUALS |'date-of',[EXPRESSEDDISPLEASURE |(DAS/MA), (Director of NMP)|], "today"|}
{EQUALS |'truth-of'(DAS/MA statements), "true"|}
{EQUALS |'truth-of'(DAS/MA statements), "not true"|}
{DEPENDSON |'truth-of'(DAS/MA statements), 'nature-of'(Meeting)|}
{EQUALS |'stance-of'(Director of NMP), "defensive"|}
{EQUALS |'status-of'(Director of NMP), "needs help"|}
[IDENTIFIED |(Director of NMP), (Additional activities)|]
[EVALUATES |(Director of NMP), (DAS/MA statements)|]
{DEPENDINGON |[EVALUATES |(Director of NMP), (DAS/MA statements)|], [CONSIDERS |(Director of NMP), (NMP activities)|]|}
[INFORMS |(Director of NMP), (NMP Division Director), 'ALL',[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]|]
[DETERMINES |(NMP Division Director), {IMPACT |[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], (NMP activities)|}|]
{NOIMPACT |[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], (NMP activities)|}
[INQUIRES |(Director of NMP), (NMP Division Director), 'ALL', {IMPACT |[STOPPED |(Governor of

Ohio), (Shipments of nuclear materials through Ohio)|], (NMP activities)|}|]
[INQUIRES |(Director of NMP), (NMP Division Director), 'governors-definition-of'(Cleaned-up)|]
[INQUIRES |(Director of NMP), (NMP Division Director), 'ALL', {IMPACT |[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], (NMP activities)|}|]
[INQUIRES |(Director of NMP), (NMP Division Director), {EQUALS |'governors-definition-of'(Cleaned-up), "something specific"|}|]
[INQUIRES |(Director of NMP), (NMP Division Director), {EQUALS |'governors-definition-of'(Cleaned-up), (A specific FMPC clean-up task)|}|]
[INQUIRES |(Director of NMP), (NMP Division Director), {INCLUDES |(NMP capabilities), (A specific FMPC clean-up task)|}|]
[INQUIRES |(Director of NMP), (NMP Division Director), 'governors-definition-of'(Cleaned-up)|]
[INQUIRES |(Director of NMP), (NMP Division Director), [SHIFTRESOURCES |(Director of NMP)|]|]
[INQUIRES |(Director of NMP), (NMP Division Director), 'importance-of'(FMPC)|]
{EQUALS |'date-of'(Leak from one of the tanks at FMPC), "last week"|}
{IFTHEN |{EQUALS |'date-of'(Leak from one of the tanks at FMPC), "last week"|}, AND {EQUAL |'date-of',[INFORMS |(Someone), (Director of NMP), 'ALL'(Leak from one of the tanks at FMPC)|], "now"|}, {EQUALS |'existence-of'(Other problems), "exists"|}|}
[UNDERSTAND |(Director of NMP), 'nature-of'(Leak from one of the tanks at FMPC)|]
[UNDERSTAND |(Director of NMP), 'ALL'(Leak from one of the tanks at FMPC)|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'reporting-of'(Leak from one of the tanks at FMPC), "proper"|}|]
[INQUIRES |(Director of NMP), (NMP Division Director), 'ALL'(Leak from one of the tanks at FMPC)|]
{EQUALS |'status-of'(All reactors), "shut down"|}
[INFORMS |(Someone), (Director of NMP), (Plans for reorganization of DOE)|]
{EQUALS |(Rumors), (Rumors)|}
[CONSIDERS |(Director of NMP), (Plans for reorganization of DOE)|]
[EVALUATES |(Director of NMP), (DAS/MA statements)|]
[CONSIDERS |(Director of NMP), (NMP activities)|]

B.2.4 Subject 2, Exercise 4

B.2.4.1 Transcript

The fact that Bush just won and since it's scenario 4 may I assume it's re-election. Now we're out to 92? Is that the way this was intended to play? [No, this is instead of Reagan, 88.] Oh, okay. So I shouldn't necessarily assume that the exercises are running, [not sequentially] they are not sequentially.
Okay. Bush won. And I guess the first thing, I'll just make a quick conclusion on that. If Bush won, at least the same party was still in control of the Executive Branch and one would now just want to watch over the next several months, what changes Bush might impose. But one could assume the status quo at least for some period of time. You could assume that Bush is probably going to carry on for some period of time pretty much with the initiatives that were already under way. So that in itself, you're comfortable in that you say well at least it's the same party, and some of the people may have played a part in the other administration. So no big revelation with that one.

Point 2. If environmental managers have won against me in an internal battle, and the Secretary has shut down all the reactors for an environmental review, this is going to have a dramatic impact back to my program, the basic scenario here considered that we're operating the three reactors. And I'm already going to be short of product in seven years. So that now, the thing that I'm going to need to do is get closely coupled over this environmental review and I'm going to need to stay closely coupled to see what can be done to minimize it's impact on the reactor operations ultimately. And that means staying in not only close touch with the environmental thing. What's left out here is you've said they've won a battle to take them down, the Secretary says take the reactors down. But what is missing is part of this piece, for what purpose? Why are they down? Is there a specific thing that he wants fixed? Is there a specific environmental impact that they want fixed or dealt with? Or is there something larger? Then it's another matter.

The congressmen still pushing for a new production reactor capability, and I will assume that new production reactor capability is not in my shop. 88 89, that's about when NPR went out. It's of interest to me because that's going to be the replacement for my capability, but if I might, I'm going to, for my purpose, hey it's not mine directly.

And I've just been notified that I must testify before the House Armed Service Committee on my ability to meet national security requirements. First thing I'm going to do is come back to my managers and I'm going to ask for an assessment of this environmental concern that's been raised. I want to know what it was. I presume I will have known. But we need to know what, what's the prognosis for restart, all of those things. Again, I know I need to get these reactors back as soon as possible. So I need a whole analysis around this. I need inputs from the site, from the environmental people who have characterized this problem, to put together possible ways to fix whatever this concern is and to get restarted. That's the thrust.

With that as input, I can have my group of production analysts putting together the supply / demand scenarios opposite the current force structure and what the reactor, and I'd do a series of cases, based around how long will the reactors be down in order to recoup this environmental impact on production. And then before HASC I can say, in order to address these environmental concerns, we have projected a certain impact. Then I need to know are all three reactors impacted and do they have to be done simultaneously, or can I do it a fix at a time. This suggests all the reactors were shut down for a review. So I guess what I've got to say, or what we've got to put together is scenarios around an environmental review. If you took something down for an environmental review, Martin, I don't know if it's the choice of the words, I can't believe that you'd shut them down for an "environmental review"; I would expect an environmental review to be done while they were operating. If there was some impact on the environment that was unacceptable, then you'd take them down. But we won't argue with the words. If they were taken down for an environmental review, then I've got a different set of scenarios. I've got the time for the review and that might be done in two months, maybe less. Now it's whatever I find out from that review that might impact me. Does that have to be fixed before I get restarted? Can I do them one reactor at a time? I've got this whole laundry list of things that I now need analyzed and appropriately I have to now have for the HASC testimony the next day, I need to say I've taken them out for an environmental review, I expect that review to take umpty-squat months. And then I give them a family of curves that would project production if we implement environmental fixes sequentially or in parallel. I could give them a whole family of curves of what I could produce under various scenarios. And I could show how much shortfall there might be over demand. That's how I'd go about this.

B.2.4.2 Translation

The presidential elections are over and George Bush won.
The Republican party is still in control of the Exeuctive Branch.

The Director of NMP considers the changes President Bush imposes over the next several months.
The change in policies affecting DOE are no changes.
President Bush will support the current initiatives for some period of time.
The Republican party is still in control of the Exeuctive Branch.
President Bush was the Vice President in the previous administration.
The outcome of the battle is DOE environmental managers won.
As a result of the outcome of the battle, the Secretary of Energy shut down all the reactors.
The reason for shutting down all the reactors was to conduct an environmental review.
The fact the Secretary of Energy shut down the reactors has a severe impact on being short of material in seven years.
With three reactors operating NMP was going to be short of material in seven years.
All the reactors shut down will severely impact the fact that NMP will be short of material in seven years.
The Director of NMP closely monitors the environmental review.
The reason for the Director of NMP to closely monitor the environmental review is to find ways to minimize the impact of the reactor shut down on NMP activities.
The Director of NMP closely monitors the environmental review.
The outcome of the battle is DOE environmental managers won.
As a result of the outcome of the battle, the Secretary of Energy shut down all the reactors.
The Director of NMP inquires of someone why the status of all the reactors is shut down.
The Director of NMP inquires of someone if there exists a specific thing the Secretary of Energy wants fixed about the reactors.
The Director of NMP inquires of someone if there is a specific environmental impact that the DOE environmentalists want fixed.
The Director of NMP inquires of someone if the problem is larger than a single specific thing.
If the problem is larger than a single specific thing, then there exists a bigger problem.
Some congressmen support a new production reactor capability.
NMP does not own new production reactor capability.
The time period of NMP does not own new production reactor capability was 1988-1989.
New production reactor capability is the replacement for reactors that NMP owns.
The Director of NMP was just notified by someone about testifying before HASC.
The Director of NMP directs his staff to evaluate the environmental review.
The Director of NMP inquires of his staff all about the environmental review.
The Director of NMP knows all about the environmental review.
The Director inquires of his staff the plans for restart of all the reactors.
The Director of NMP needs for the date of restarting all reactors to be as soon as possible.
The Director of NMP needs his staff to evaluate all about the environmental review.
The Director of NMP inquires of SR all about the status of the reactors being shut down.
The Director of NMP inquires of DOE environmental managers all about the environmental review.
The Director of NMP prepares a plan for solving the environmental concerns.
The Director of NMP prepares a plan for restarting all the reactors.
The Director of NMP directs the Planning Division Director to prepare new supply/demand cases including the impact of the environmental review on NMP activities and the current stockpile case.
The Director of NMP directs the Planning Division Director to prepare new supply/demand cases which include the impact of the environmental reivew on NMP activities and the plan for restarting the reactors.
The Director of NMP informs HASC of the new supply/demand cases.
The plans for restarting each reactor is independent.
The plans for restarting each reactor is dependent on the plans for restarting all reactors.
The status of all reactors is shut down.
The Director of NMP directs the Planning Division Director to prepare new supply/demand cases which include the impact of the environmental reivew on NMP activities and the plan for restarting the

reactors.
An environmental review would be conducted during normal operation of the reactors.
The reason for the reactors to be shut down was an environmental impact that was unacceptable.
The time period of the environmental review may only be two months.
The time period of the environmental review may be less than two months.
The Director of NMP inquires of someone if the recommendations from the environmental review have to be addressed prior to restarting the reactors.
The Director of NMP needs for someone to evaluate the environmental review prior to testifying to the HASC.
The date of the Director of NMP testifying before HASC is tomorrow.
The Director of NMP informs HASC all about the environmental review.
The Director of NMP informs HASC of the time period of the environmental review.
The Director of NMP informs HASC of the new supply/demand cases.
The nature of the evaluation of the impact of the environmental review on the supply of nuclear materials is parametric.
The plans for restarting each reactor is independent.
If the plans for restarting each reactor are independent then the number of reactors that can be restarted equals two.
The Director of NMP informs HASC of the new supply/demand cases.

B.2.4.3 Coded Protocol

{EQUALS l'who-won'(Presidential elections), (President Bush)l}
{CONTROLS l(Republican Party), (Executive Branch)l}
{EQUALS l'time-period-of',[CONSIDERS l(Director of NMP), [CHANGES l(President Bush), (Administrative policies)l]l], "several months"l}
{EQUALS l'change-in'(Administrative policies), "none"l}
{EQUALS l'time-period-of',[SUPPORT l(President Bush), (Current NMP initiatives)l], "some time"l}
{CONTROLS l(Republican Party), (Executive Branch)l}
{EQUALS l'time-period-of',{EQUALS l'position-of'(President Bush), (Vice-President)l}, "in the previous administration"l}
{EQUALS l'who-won',[DISAGREE l(Director of NMP), (DOE environmental managers), 'status-of'(All reactors)l], (DOE environmental managers)l}
[SHUTDOWN l(Secretary of Energy), (All reactors)l]
{EQUALS l'reason-for',[SHUTDOWN l(Secretary of Energy), (All reactors)l], "environmental review"l}
{EQUALS l'severity-of',{IMPACT l[SHUTDOWN l(Secretary of Energy), (All reactors)l], {EQUALS l'date-of'(Crossover point of all material), "seven years"l}l}, "severe"l}
{WITH l{EQUALS l'status-of'(All reactors), "operating"l}, {EQUALS l'date-of'(Crossover point of all material), "seven years"l}l}
{EQUALS l'severity-of',{IMPACT l{EQUALS l'status-of'(All reactors), "shut down"l}, {EQUALS l'date-of'(Crossover point of all material), "seven years"l}l}, "severe"l}
[MONITORS l(Director of NMP), (Environmental review)l]
{EQUALS l'reason-for',[MONITORS l(Director of NMP), (Environmental review)l], [MINIMIZE l(Director of NMP), {IMPACT l{EQUALS l'status-of'(All reactors), "shut down"l}, {EQUALS l'date-of'(Crossover point of all material), "seven years"l}l},l]l}
[MONITORS l(Director of NMP), (Environmental review)l]
{EQUALS l'who-won',[DISAGREE l(Director of NMP), (DOE environmental managers), 'status-of'(All reactors)l], (DOE environmental managers)l}
[SHUTDOWN l(Secretary of Energy), (All reactors)l]

[INQUIRES |(Director of NMP), (Someone), 'why',[SHUTDOWN |(Secretary of Energy), (All reactors)|]|]
[INQUIRES |(Director of NMP), (Someone), [WANTS |(Secretary of Energy), {EQUALS |'status-of'(A specific reactor environmental task), "complete"|}|]|]
[INQUIRES |(Director of NMP), (Someone), [WANTS |(DOE environmental managers), {EQUALS |'status-of'(A specific reactor environmental task), "complete"|}|]|]
[INQUIRES |(Director of NMP), (Someone), {BIGGERTHAN |'nature-of'(Environmental review), (A specific reactor environmental task)|}|]
{IFTHEN |{BIGGERTHAN |'nature-of'(Environmental review), (A specific reactor environmental task)|}, {EQUALS |'existence-of'(Bigger problem), "exists"|}|}
[SUPPORT |(Some congressmen), (New production reactor capability)|]
{DOESNOTOWN |(NMP), (New production reactor capability)|}
{EQUALS |'time-period-of',{DOESNOTOWN |(NMP), (New production reactor capability)|}, "1988-1989"|}
{EQUALS |(New production reactor capability), (Replacement for NMP reactors)|}
[INFORMS |(Someone), (Director of NMP), [WILLTESTIFY |(Director of NMP), (HASC), (NMPs ability to meet national security requirements)|]|]
[DIRECTS |(Director of NMP), (Staff), [EVALUATE |(Staff), 'ALL'(Environmental review)|]|]
[INQUIRES |(Director of NMP), (Staff), 'ALL'(Environmental review)|]
[KNOWS |(Director of NMP), 'ALL'(Environmental review)|]
[INQUIRES |(Director of NMP), (Staff), 'plan-for-restart'(All reactors)|]
[NEEDS |(Director of NMP), {EQUALS |'date-of',{EQUALS |'status-of'(All reactors), "operating"|}, "as soon as possible"|}|]
[NEEDS |(Director of NMP), [EVALUATE |(Staff), 'ALL'(Environmental review)|]|]
[INQUIRES |(Director of NMP), (SR), 'status-of',{EQUALS |'status-of'(All reactors), "shut down"|}|]
[INQUIRES |(Director of NMP), (DOE environmental managers), 'ALL'(Environmental review)|]
[PREPARES |(Director of NMP), 'plan-for-solution-of'(Environmental concerns)|]
[PREPARES |(Director of NMP), 'plan-for-restart'(All reactors)|]
[DIRECTS |(Director of NMP), (Planning Division Director), [PREPARE |(Planning Division Director), {INCLUDES |(New supply/demand cases), {IMPACT |(Environmental review), (NMP activities)|}, AND (Current stockpile case)|}|]|]
[DIRECTS |(Director of NMP), (Planning Division Director), [PREPARE |(Planning Division Director), {INCLUDES |(New supply/demand cases), {IMPACT |(Environmental review), (NMP activities)|}, AND 'plan-for-restart'(All reactors)|}|]|]
[INFORMS |(Director of NMP), (HASC), 'ALL'(New supply/demand cases)|]
{INDEPENDENT |'plan-for-restart'(L-reactor), 'plan-for-restart'(K-reactor), 'plan-for-restart'(P-reactor)|}
{DEPENDSON |'plan-for-restart'(L-reactor), 'plan-for-restart'(K-reactor), 'plan-for-restart'(P-reactor)|}
{EQUALS |'status-of'(All reactors), "shut down"|}
[DIRECTS |(Director of NMP), (Planning Division Director), [PREPARE |(Planning Division Director), {INCLUDES |(New supply/demand cases), {IMPACT |(Environmental review), (NMP activities)|}, AND 'plan-for-restart'(All reactors)|}|]|]
{EQUALS |'time-period-of'(Environmental review), 'time-period-of',{EQUALS |'status-of'(All reactors), "operating"|}|}
{EQUALS |'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "an unacceptable environmental impact"|}
{EQUALS |'time-period-of'(Environmental review), "two months"|}
{EQUALS |'time-period-of'(Environmental review), "less than two months"|}
[INQUIRES |(Director of NMP), (Someone), {BEFORE |[EXECUTING |(Recommendations from the environmental review)|], [RESTARTING |(All reactors)|]|}|]
[NEEDS |(Director of NMP), {BEFORE |[EVALUATE |(Someone), 'ALL'(Environmental review)|], [WILLTESTIFY |(Director of NMP), (HASC)|]|}|]
{EQUALS |'date-of',[WILLTESTIFY |(Director of NMP), (HASC)|], "tomorrow"|}

[INFORMS |(Director of NMP), (HASC), 'ALL'(Environmental review)|]
[INFORMS |(Director of NMP), (HASC), 'time-period-of'(Environmental review)|]
[INFORMS |(Director of NMP), (HASC), 'ALL'(New supply/demand cases)|]
{EQUALS |'nature-of',[EVALUATE |(Planning Division Director), {IMPACT |(Environmental review), (Supply of nuclear material)|}|], "parametric"|}
{INDEPENDENT |'plan-for-restart'(L-reactor), 'plan-for-restart'(K-reactor), 'plan-for-restart'(P-reactor)|}
{IFTHEN |{INDEPENDENT |'plan-for-restart'(L-reactor), 'plan-for-restart'(K-reactor), 'plan-for-restart'(P-reactor)|}, {EQUALS |'number-of',[RESTART |(All reactors)|], "two"|}|}
[INFORMS |(Director of NMP), (HASC), 'ALL'(New supply/demand cases)|]

B.2.5 Subject 2, Exercise 5

B.2.5.1 Transcript

Okay. Let's walk these through one by one. WIPP is not going to come on-line anywhere near the estimated time and rumor is it may never come on-line. To NMP, that has dramatic implications from the point of view as we all know, WIPP is absolutely essential to the continued operation of Rocky Flats. So, if it or some other accommodation isn't met, you're out of the weapons business. So that one has very, very significant and dire consequences. While WIPP is going to receive some TRU wastes, I believe, from Savannah River, which is one of our sites, the stuff that it's going to receive is properly stored on TRU pads, and it's not a problem. But at Rocky, it's a significant problem. So the way this one's going to be very important to us, is in what it's going to do opposite the stockpile, the ability to support weapons production, and that kind of thing. So if we deal with that one, maybe that's another way to tackle this. If we deal with that first, the first thing I'm going to need to do when I get to discussing or talking to my managers is we need somebody to run the trap lines on the implications of WIPP. Somebody immediately, while WIPP is an EM project, it's got dire consequences for the DAS for Military Application. And that's our tie for the immediate time frame. I'd say to the managers, we need to stay tied into that, because we need to know what that's going to do. There aren't, you could think of a lot of possible scenarios with and without WIPP, but they're all going to be Rocky driven. And, so there, the first order problem is to establish close contact with DAS Military Application and stay tuned in and timed in on that. Secondarily, you might look to what kind of support your facilities might be able to give, because of that. And they are very limited, as you know. It's limited what we might do for Rocky. And so there's not a whole lot one might do. Through EM you might explore what you can do about bringing material over, but right away, DAS/MA's got the immediate problem dealing with EM and trying to work a solution. And in fact, that's exactly where we are today. That is a very real one.
The second one. All the reactors have been shut down this week for environmental review and the Secretary has said in several meetings that he intends to create a special task force for restarting them. That's going to be very similar to exercise 4 which we've discussed just a few moments ago, in that we want to understand that environmental review, it's impacts and what have you. Now the creating of a special task force for restarting them, now implies that I've got them down for an environmental review, but before I let them restart, I want to have this task force that's going to decide that it's okay to do so. If he's taken them out for an environmental review, I'd like to hope that that task force scope is going to be limited too. I took them out for environmental review and I want a task force to look at the results of that review and say yes, it's okay to restart (the basis for restart, any criteria that have to

be met, all of that). But in turn, the first thing that I'm going to have to do is, working through the AS/DP, assure that we're participants in that task force. We need to be tied in with what that task force does. We need to be tied in with that review. We need to be sure that the affected field site is properly tied in with that review and a party to it. So I've got to do that.

And with that will be all of the exercises that were part of exercise 4. What's going to happen to production with various down times? There you'd probably do a parametric study. If it's down for two months, the curves will now look like this. This is what happens if they're down for six months. This is what happens if they're down for a year. This should bracket where you're headed.

The recent report by one of your division directors indicated major break-through's in SIS technologies. That's curious, at best. I read the basic, the fundamental scenario, which says seven years from now, I'm short in plutonium. Looking at how long it takes to get a project authorized and all, my guess would be you couldn't bring that SIS on in time to solve that plutonium problem. But if in fact there had been a break-through at this point, and there, and I'm presuming another office within AS/DP is managing, as they have been, then I would have my production analysts, working with those people to look at, if there were these break-through's, what is the office responsible for that doing? What are the prognoses? How much sooner? When could the thing be on-line? What's happening with these wonderful break-through's? And if it was realistic to do so, one might then be able to show a curve if SIS came on within that seven year period, what might it be able to deliver to the system and what might it do to plutonium supply. Not-with-standing the fact that somebody might want to pay for that out of your budget, one of the other things you'd have to see is at what cost? Whose ox is going to be gored? Because if the AS/DP is suddenly very excited about that, they might be looking for funding. Although, if you're out with reactors, and tritium is and continues to be goal number one, right now the fundamental focus has got to be on the tritium and meeting the tritium mission. So that's what I see happening there. But you do need to go find out more about this break-through and what it means. What does it mean? Does it mean that it's looking so great that they're going to be able to recover meaningful quantities within the seven year time frame? Then it's of some importance, and if it can't happen for 10 or 12 years, then it's nice, but who cares? Somebody does, but you don't.

There are at least two new stockpile cases a week because of the suspected U.S. - Soviet agreements expected from various Bush / Gorbachev. That sounds unrealistic, two new stockpile cases a week. You don't usually see it. We do a lot of cases, and Howard knows it more these days, he's been doing a lot of what-if's. That's a curious thing. My people are heavily involved in that, running those various cases. It's hard for me to tell if they could support two new cases, it depends on the nature of the cases and how dramatically different the cases are. My guess is that you could probably just about do that with the latest tools we've got. And if that were the case, great. You'd start generating them. And you'd start putting them in the hands of, and I'm no decision maker, but you'd start putting them in the hands of the decision makers, saying well boys, here are the various things that are coming down. But you'd be doing it with an eye toward fundamentals here, the basic thing. And you'd be looking at stockpile cases. And you'd want to be matching the base case and the stockpile memo that gave us this scenario that says in seven years I'm short in these materials. And I would then want to have that as an overlay to show, or these as overlays, to start showing what any and all of these alternate stockpile cases might do. But it would be nothing more at this point than information, not decision. Other than, particularly if they were going down and not only in tritium but in plutonium, one could say, why, that's wonderful that we're making major break-through's in SIS, but understand, that if any, if some of these scenarios ever got played out, it would be monies that the Department might be investing in a time frame when there's no need to go that fast. But then I go back to the fundamental that Gorbachev/Bush is wonderful, but until it's a done deal, until there is a START treaty, I'm the man that's responsible for producing the materials to supply the stockpile, these are all things that might make you feel a little more comfortable. You might feel that you're going to be taken off the hook, but you may not be. You've still got to plan for that, until it's officially changed.

B.2.5.2 Translation

The status of WIPP startup is nowhere near the estimated time.
The rumors about WIPP are WIPP may never come on-line.
The status of WIPP startup being nowhere near the estimated time has severe impact on NMP activities.
WIPP is essential to the continued operation of RFP.
If alternatives to WIPP don't exist then the weapons complex is shut down.
The impact of WIPP startup on NMP activities is severe.
WIPP will receive TRU waste from SR.
NMP owns SR.
The status of TRU waste at SR is properly stored on TRU pads.
TRU waste at SR is not a problem.
TRU waste at RFP is a significant problem.
The status of WIPP impacts NMP activities.
The Director of NMP inquires of someone the impact of the WIPP status on the current stockpile case.
The Director of NMP inquires of someone the impact of the WIPP status on the Weapons complex.
The Director of NMP needs Staff to evaluate the impact of the status of WIPP on NMP activities.
EM owns WIPP.
The impact of WIPP startup on the status of the Weapons complex is severe.
The status of the weapons complex impacts the status of NMP.
The Director of NMP directs staff to monitor the status of WIPP.
The Director of NMP needs to know the impact of the status of WIPP on NMP activities.
Supply/demand cases exist which include WIPP.
Supply/demand cases exist which exclude WIPP.
Rocky Flats drives the supply/demand cases.
The Director of NMP establishes contact with DAS/MA to monitor the impact of the status of WIPP on the status of RFP.
The Director of NMP inquires of someone if alternatives to WIPP exist within NMP.
The number of alternatives to WIPP within NMP are limited.
The number of alternatives to WIPP are few.
The Director of NMP works with EM to evaluate alternatives to WIPP.
The DAS/MA works with EM on alternatives to WIPP.
The DAS/MA works with EM to prepare a plan for solution of the status of WIPP.
The status of all reactors is shut down.
The Secretary of Energy shut down all the reactors this week.
The reason for the shut down was for environmental review.
The Secretary of Energy will create a special task force for restarting all the reactors.
The Secretary of Energy has said he intends to create a special task force for restarting all the reactors..
The Director of NMP must understand all about the environmental review.
The Director of NMP must understand the impact of the environmental review on NMP activities.
All the reactors are down for an environmental review.
Creating the special task force implies restarting the reactors depends on task force approval.
The reason for the Secretary shutting down all the reactors is for an environmental review.
The scope of the special task force is limited to approving the restart of the reactors.
The reason for the Secretary shutting down all the reactors is for an environmental review.
The special task force reviews and approves the execution of the recommendations from the environmental review prior to restarting the reactors.
The Director of NMP inquires of someone the criteria for approval to restart the reactors.
The Director of NMP works with the AS/DP to ensure NMP is a member of the special task force for

restarting the reactors.
The Director of NMP monitors the activities of the special task force for restarting the reactors.
The Director of NMP ensures that SR is a member of the special task force for restarting the reactors.
The Director of NMP inquires of someone the impact of the environmental review on NMP activities.
The nature of the evaluation of the impact of the environmental review on the supply of nuclear materials is parametric.
The Director of NMP inquires of the Planning Division Director what is the new supply/demand case including the time period of reactor shut down of two months.
The Director of NMP inquires of the Planning Division Director what is the new supply/demand case including the time period of reactor shut down of six months.
The Director of NMP inquires of the Planning Division Director what is the new supply/demand case including the time period of reactor shut down of one year.
A recent report indicates major break-through's in SIS technologies.
The interest level of the Director of NMP about the report on major, SIS break-throughs is curious at best.
The crossover point for plutonium in the current stockpile case is seven years.
The length of time to bring a major project on-line and the crossover point for plutonium imply SIS would not be on-line to solve the plutonium problem.
Another office within DP owns SIS.
If the the report on major break-through's in SIS technology is true, the Director of NMP directs staff to evaluate the report.
If the report on SIS is true, the Director of NMP inquires of someone the plan for SIS.
The Director of NMP inquires of someone the plan for startup of SIS.
If the report on SIS is true, the Director of NMP inquires of someone the plan for SIS.
The Director of NMP inquires of someone if the quality of the plan for startup of SIS is realistic.
Someone prepares a new supply/demand case including SIS.
The Director of NMP inquires of someone the production of SIS.
The Director of NMP inquires of someone the impact of the production of SIS on the crossover point for plutonium.
Someone may want funding for SIS to be within the NMP budget.
The Director of NMP inquires the cost of SIS.
The Director of NMP inquires the source of funding for SIS.
If the level of interest of the AS/DP about SIS was very excited, the AS/DP might look for funding sources for SIS.
The status of all the reactors is shut down.
The priority of tritium production is first.
The first priority of the Director of NMP is to supply enough tritium to meet the demand for tritium.
The Director of NMP inquires all about the report of major break-through's in SIS.
The Director of NMP inquires all about the impact of the report of major break-throughs in SIS on NMP activities.
The Director of NMP inquires if the time period of meaningful production from SIS is within seven years.
If the time period of meaningful production from SIS is within seven years then the value of the report on major break-throughs in SIS is important.
If the time period of meaningful production from SIS is ten or twelve years then the value of the report on major break-throughs in SIS is not important.
The number of new stockpile cases is two per week.
U.S.-Soviet agreements could be forthcoming.
Someone suspects U.S.-Soviet agreements to be forthcoming.
The reason for the number of new stockpile cases is someone suspects U.S.-Soviet agreements to be forthcoming.
The occurence of two new stockpile cases per week is unusual.
The number of new stockpile cases is many.

The staff participate in new stockpile cases.
The Director of NMP inquires of someone if the staff could support two new stockpile cases per week
The staff supporting two new stockpile cases per week depends on the nature of the new stockpile cases.
With the latest NMP tools the staff could support two new stockpile cases per week.
The staff prepares new supply/demand cases including the new stockpile cases.
The Director of NMP is not a decision maker.
The Director of NMP provides the decision maker with the new supply/demand cases.
The Director of NMP considers the new stockpile cases.
The Director of NMP compares the new stockpile cases with the current stockpile case.
The Director of NMP compares new supply/demand cases with the current supply/demand case.
If the crossover point for both materials exists in the new supply/demand cases, the value of SIS is minimal.
The Gorbachov and Bush arms limitations talks have no impact on NMP activities until there are treaties.
The Director of NMP must provide the material called for in the current Presidential Stockpile Memorandum.

B.2.5.3 Coded Protocol

{EQUALS I'status-of'(WIPP), "nowhere near the estimated time"I}
{EQUALS I'rumors-about'(WIPP), "may never come on-line"I}
{EQUALS I'severity-of',{IMPACT I{EQUALS I'status-of'(WIPP), "nowhere near the estimated time"I},
(NMP activities)I}, "severe"I}
{ESSENTIAL I(WIPP), {EQUALS I'status-of'(RFP), "operating"I}I}
{EQUALS I{EQUALS I'existence-of'(Alternatives to WIPP), "dont exist"I}, {EQUALS I'status-of'(Weapons
complex), "shut down"I}I}
{EQUALS I'severity-of',{IMPACT I{EQUALS I'status-of'(WIPP), "nowhere near the estimated time"I},
(NMP activities)I}, "severe"I}
{WILLRECEIVE I(WIPP), (SR), (TRU waste)I}
{OWNS I(NMP), (SR)I}
{EQUALS I'status-of'(TRU waste at SR), "properly stored on TRU pads"I}
{EQUALS I'status-of'(TRU waste at SR), "not a problem"I}
{EQUALS I'status-of'(TRU waste at RFP), "significant problem"I}
{IMPACT I'status-of'(WIPP), (NMP activities)I}
[INQUIRES I(Director of NMP), (Someone), {IMPACT I'status-of'(WIPP), (Current stockpile case)I}I]
[INQUIRES I(Director of NMP), (Someone), {IMPACT I'status-of'(WIPP), (Weapons complex)I}I]
[NEEDS I(Director of NMP), [EVALUATE I(Staff), {IMPACT I'status-of'(WIPP), (NMP activities)I}I]I]
{OWNS I(EM), (WIPP)I}
{EQUALS I'severity-of',{IMPACT I'status-of'(WIPP), (Weapons complex)I}, "severe"I}
{IMPACT I'status-of'(WIPP), 'status-of'(NMP)I}
[DIRECTS I(Director of NMP), (Staff), [MONITOR I(Staff), 'status-of'(WIPP)I]I]
[NEEDS I(Director of NMP), [KNOW I{IMPACT I'status-of'(WIPP), (NMP activities)I}I]I]
{EQUALS I'existence-of',{INCLUDE I(New supply/demand cases), (WIPP)I}, "exists"I}
{EQUALS I'existence-of',{EXCLUDE I(New supply/demand cases), (WIPP)I}, "exists"I}
{DRIVINGFORCE I(RFP), (New supply/demand cases)I}
[ESTABLISHESCONTACT I(Director of NMP), (DAS/MA), [MONITOR I(Director of NMP), {IMPACT
I'status-of'(WIPP), 'status-of'(RFP)I}I]I]
[INQUIRES I(Director of NMP), (Someone), {EQUALS I'existence-of',{WITHIN I(Alternatives to WIPP),
(NMP)I}I}I]
{EQUALS I'number-of',{WITHIN I(Alternatives to WIPP), (NMP)I}, "limited"I}
{EQUALS I'number-of'(Alternatives to WIPP), "few"I}
[WORKSWITH I(Director of NMP), (EM), [EVALUATE I(Director of NMP), (Alternatives to WIPP)I]I]

[WORKSWITH |(DAS/MA), (EM), [EVALUATE |(DAS/MA), (Alternatives to WIPP)|]|]
[WORKSWITH |(DAS/MA), (EM), [PREPARE |(EM), 'problem-solution-for',{EQUALS |'status-of'(WIPP), "nowhere near the estimated time"|}|]|]
{EQUALS |'status-of'(All reactors), "shut down"|}
{EQUALS |'date-of',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "this week"|}
{EQUALS |'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "environmental review"|}
[CREATE |(Secretary of Energy), (Special task force for restarting all the reactors)|]
[INTENDS |[CREATE |(Secretary of Energy), (Special task force for restarting all the reactors)|]|]
[UNDERSTAND |(Director of NMP), 'ALL'(Environmental review)|]
[UNDERSTAND |(Director of NMP), 'ALL',{IMPACT |(Environmental review), (NMP activities)|}|]
{EQUALS |'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "environmental review"|}
{IMPLIES |[CREATE |(Secretary of Energy), (Special task force for restarting all the reactors)|], {DEPENDSON |[RESTART |(All reactors)|], [APPROVES |(Special task force for restarting all the reactors), [RESTART |(All reactors)|]|]|}|}
{EQUALS |'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "environmental review"|}
{EQUALS |'scope-of'(Special task force for restarting all the reactors), [APPROVES |(Special task force for restarting all the reactors), [RESTART |(All reactors)|]|]|}
{EQUALS |'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "environmental review"|}
{BEFORE |[REVIEWS/APPROVES |(Special task force for restarting all the reactors), [EXECUTING |(Recommendations from the environmental review)|]|], [RESTART |(All reactors)|]|}
[INQUIRES |(Director of NMP), (Criteria for approval to restart all the reactors)|]
[WORKSWITH |(Director of NMP), (AS/DP), [ENSURE |{ISAMEMBER |(NMP), (Special task force for restarting all the reactors)|}|]|]
[MONITORS |(Director of NMP), 'ALL'(Special task force for restarting all the reactors)|]
[ENSURE |(Director of NMP), {ISAMEMBER |(SR), (Special task force for restarting all the reactors)|}|]
[INQUIRES |(Director of NMP), (Someone), {IMPACT |(Environmental review), (NMP activities)|}|]
{EQUALS |'nature-of',[EVALUATE |(Planning Division Director), {IMPACT |(Environmental review), (Supply of nuclear material)|}|], "parametric"|}
[INQUIRES |(Director of NMP), (Planning Division Director), {INCLUDES |(New supply/demand cases), {EQUALS |'time-period-of'(Environmental review), "two months"|}|}|]
[INQUIRES |(Director of NMP), (Planning Division Director), {INCLUDES |(New supply/demand cases), {EQUALS |'time-period-of'(Environmental review), "six months"|}|}|]
[INQUIRES |(Director of NMP), (Planning Division Director), {INCLUDES |(New supply/demand cases), {EQUALS |'time-period-of'(Environmental review), "one year"|}|}|]
[PUBLISHED |(NMP Division Director), (Report on major, SIS break-throughs)|]
[INTERESTIN |(Director of NMP), (Report on major, SIS break-throughs), "curious at best"|]
{EQUALS |'crossover-for-plutonium-of'(Current stockpile case), "seven years"|}
{IMPLIES |(Time to bring a major project on-line), AND {EQUALS |'crossover-for-plutonium-of'(Current stockpile case), "seven years"|}, [WOULDNOTSOLVE |(SIS), (Plutonium problem)|]|}
{OWNS |(Another DP office), (SIS)|}
[IFTHEN:DIRECTS |{EQUALS |'truth-of'(Report on major, SIS break-throughs), "true"|}, (Director of NMP), (Staff), [EVALUATE |(Report on major, SIS break-throughs)|]|]
[IFTHEN:INQUIRES |{EQUALS |'truth-of'(Report on major, SIS break-throughs), "true"|}, (Director of NMP), (Someone), 'plan-for'(SIS)|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for-startup'(SIS)|]
[IFTHEN:INQUIRES |{EQUALS |'truth-of'(Report on major, SIS break-throughs), "true"|}, (Director of NMP), (Someone), 'plan-for'(SIS)|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'quality-of-the-plan-for-startup'(SIS), "realistic"|}|]
[PREPARES |(Someone), {INCLUDES |(New supply/demand cases), (SIS)|}|]
[INQUIRES |(Director of NMP), (Someone), 'production-of'(SIS)|]
[INQUIRES |(Director of NMP), (Someone), {IMPACT |'production-of'(SIS), (Crossover point for

plutonium)|]|]
[WANT |(Someone), {EQUALS |'source-of-funding'(SIS), (NMP)|]|]
[INQUIRES |(Director of NMP), (Someone), 'cost-of'(SIS)|]
[INQUIRES |(Director of NMP), (Someone), 'source-of-funding'(SIS)|]
[IFTHEN:SEEK |{EQUALS |'level-of-interest'(AS/DP), (SIS), "very excited"|}, 'source-of-funding'(SIS)|]
{EQUALS |'status-of'(All reactors), "shut down"|}
{EQUALS |'priority-of'(Tritium production), "first"|}
{EQUALS |'priority-of'(Director of NMP), [PROVIDES |(Director of NMP), {EQUALS |'production-of'(Tritium), 'demand-for'(Tritium)|]|], "first"|}
[INQUIRES |(Director of NMP), (Someone), 'ALL'(Report on major, SIS break-throughs)|]
[INQUIRES |(Director of NMP), (Someone), 'ALL',{IMPACT |(Report on major, SIS break-throughs), (NMP activities)|]|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'time-period-of',{EQUALS |'production-of'(SIS), "meaningful quantities"|}, "within seven years"|}|]
{IFTHEN |{EQUALS |'time-period-of',{EQUALS |'production-of'(SIS), "meaningful quantities"|}, "within seven years"|}, {EQUALS |'value-of'(Report on major, SIS break-throughs), "important"|}|}
{IFTHEN |{EQUALS |'time-period-of',{EQUALS |'production-of'(SIS), "meaningful quantities"|}, "ten or twelve years"|}, {EQUALS |'value-of'(Report on major, SIS break-throughs), "not important"|}|}
{EQUALS |'number-of'(New stockpile cases), "two per week"|}
{EQUALS |'potential-for'(U.S.-Soviet agreements), "likely"|}
[SUSPECTS |(Someone), {EQUALS |'potential-for'(U.S.-Soviet agreements), "likely"|}|]
{EQUALS |'reason-for'(New stockpile cases), [SUSPECTS |(Someone), {EQUALS |'potential-for'(U.S.-Soviet agreements), "likely"|}|]|}
{EQUALS |'occurence-of',{EQUALS |'number-of'(New stockpile cases), "two per week"|}, "unusual"|}
{EQUALS |'number-of'(New stockpile cases), "many"|}
[PARTICIPATEIN |(Staff), [PREPARE |(New stockpile cases)|]|]
[INQUIRES |(Director of NMP), (Someone), [SUPPORT |(Staff), {EQUALS |'number-of'(New stockpile cases), "two per week"|}|]|]
{DEPENDSON |[SUPPORT |(Staff), {EQUALS |'number-of'(New stockpile cases), "two per week"|}|], 'nature-of'(New stockpile cases)|}
{WITH |(Latest NMP tools), [SUPPORT |(Staff), {EQUALS |'number-of'(New stockpile cases), "two per week"|}|]|}
[PREPARES |(Staff), {INCLUDES |(New supply/demand cases), (New stockpile cases)|}|]
{NOTEQUALS |(Director of NMP), (Decision-maker)|}
[PROVIDES |(Director of NMP), (Decision-maker), (New supply/demand cases)|]
[CONSIDERS |(Director of NMP), (New stockpile cases)|]
[COMPARES |(Director of NMP), (New stockpile cases), (Current stockpile case)|]
[COMPARES |(Director of NMP), (New supply/demand cases), (Current supply/demand cases)|]
{IFTHEN:EQUALS |{HAS |(New supply/demand cases), (Crossover point of all material)|}, 'value-of'(SIS), "minimal"|}
{IFTHEN:NO-IMPACT |{EQUALS |(Signed treaties), "dont exist"|}, (Arms limitation talks), (NMP activities)|}
{PROVIDES |(Director of NMP), (Nuclear material called for in the current Presidential Stockpile Memorandum)|}

B.3 Subject 3

B.3.1 Subject 3, Exercise 1

B.3.1.1 Transcript

Given the assumptions in the scenario, I've got to produce. If I'm going to be short of tritium and plutonium, I'm going to have to have all three Savannah River reactors. My assumption would be we would need all three Savannah River reactors up and operating at least, by that time. I'm going to have to make an assumption that the seven year projection is based on K and P staying at 100% power and L at 50% power, more or less during that period of time, with some projections for outages. And that any disruption to that schedule, K and P being at 100% and L at 50%, would cause me to run short earlier because I will not be producing the material that I'm supposed to be producing. And the trick here of course is, if I'm going to run short in seven years what am I going to do about it? Kind of interesting. I'll have to sit down an think about what's behind all this. Do I have a plan for making sure that in seven years some other source of plutonium is going to be available? That L-reactor could either come up to 100% power because I've corrected the environmental problems there? Or some other source of plutonium could come available like SIS, which was still a possibility before the decision was made to not do that project? So these are all possibilities there, in the background.
But SIS was never a certainty and you never knew when it was going to come up, and the L-reactor situation, I will assume there was some problem that had to be dealt with, and I'm not sure we knew how to do that. In order not to make it even worse than this, we can't afford to loose another reactor. So, if one reactor was just shut down, the factor we have here is that somebody's interested in cutting the budget. We also have another pressure for less production which is arms limitation. So the arms limitation agreements could end up having the supply/demand curves change, so that instead of running out in seven years, we might run out in a lot longer, perhaps ten years, whatever, by which time we could have some more capacity on-line. But at this point, these are all in the talking stage. The pressure for budget limitations is real. So there will be a mood in the Congress and in the country not to spend money on production unless it's necessary. And if we had a contamination at the Rocky Flats Plant, that could mean that we were getting into trouble at Rocky Flats. Rocky Flats could be in an imminent shutdown. We could need less material because of Rocky Flats being shutdown. Or that might extend the time when we need the material.
I would first ask what the immediate situation was. Which reactor? What caused it to be shut down? Environmental safety, mechanical problem? How long do they think it's going to be shutdown? What would be the process for bringing it back up? When I get that information, while I'm getting that information, I need to decide how to deal with this in the public media. I would inform my management. We probably wouldn't inform anybody in the Congress, unless they had already made a press announcement. If they had already made a press announcement, we might call them right away just to give them the heads up that it was shutdown. But if they hadn't yet or they were going to in another couple of hours, I'd wait to at least find out why it was shutdown and what the circumstance were before I asked the managers to make sure all the people were informed. The DOD would have to be told; we'd have to inform a group of people that would be interested, the Congress, the DOD, the OMB, oversight groups unless they were the ones who shut it down in which case they would know already.

And then, I was trying to think, would it make any difference what the problem was on how you would present it? Well, we'd have to issue a press release right away anyway, because that's just the way it is and it was in 88 and 89. You would never have the time to sit around an wonder about exactly how you wanted to present this. We would put out a press release that said the reactor was shut down and why. And if we didn't know how long it would be shut down, we'd just say we didn't know how long.
But as far as what we are going to do now and how it will affect the normal operating strategies of the organization, if it were anything other than a minor mechanical shutdown, a scram, something that was understood (and sometimes we think things are understood and they're not), you would go in and investigate. At that period of time we would have been fairly paranoid about what caused it. And we would want to make sure we understood what caused it before we assumed that the reactor was going to come up quickly. If it wasn't going to come up quickly and there was going to be some extended shutdown, we would then try to find out exactly how long the shutdown would take and make our best estimate. Then to see how that would play against the supply/demand curves and at what point would we have a problem. And make sure we understood the assumptions. For instance, if we're assuming that Rocky Flats is continuing to operate at full steam, or assuming we are going to get the funding to operate the reactors and the nuclear materials complex, or assuming there are no arms limitation treaties that affect it immediately. Now you know within, I'm looking at seven years, most of those arms limitation treaties they talked about, the effect would be quite a long ways down the road, but we'd have to review it. I would ask what information do we have now? Let's say that we got a projection of a one year shutdown in the reactor--some major piece of equipment had to be replaced--and we couldn't bring the reactor up for another year. In one year, SIS would not do you any good. So if you were going to have a problem, we'd have to see what that would do. Find out and get the supply/demand curves with the new supply assumption in it and see what that would do. Then we would look at the 25% reduction in cost. That would only make it worse, if we assumed we had a 25% reduction in money. The interesting thing about a shutdown reactor is that it costs you as much to have it shutdown as it does to have it operating, sometimes more because of the cost of the upgrades that you have to do.
So we would get this new supply/demand data and we'd make a plan. We'd put together a strategic plan over the next X years, 5 years let's say, on how we would deal with having this reactor shutdown. We would probably go through a couple of scenarios. What if it takes two years to get it up instead of one year based on experience? What options would we have? At that time, I think that L-reactor was plutonium only and was going to shift to tritium, but that reactor was not producing tritium at that time. We would have to look at the mix of tritium and plutonium. We would have to look at whether it made any difference that Rocky Flats was down or not. And we'd do some additional scenarios, say what happens if Rocky Flats is down for let's say 6 months or more. How would that play against one of the Savannah River reactors? And then could we bring in any plutonium from other sites? Could we recover more scrap, for instance, from Richland? Could we do more scrap recovery at Savannah River to get more plutonium?
I don't know how far you'd go if all you knew was that the reactor was shut down, you'd have to make some assumptions. Just to make it interesting, I'll say the reactor is going to be shutdown for a year, and the arms limitation talks are looking like there could be a serious strategic arms or tactical arms limitation, one or the other. And you would sit down and look at what the possibilities were and what your options were for dealing with them. And then come up with a series of approaches to dealing with the possibilities and seeing how you could protect yourself, optimize the situation so you would be protected no matter which way it went. Like if you got a 25% reduction in the budget, and you got arms limitation, and Rocky Flats Plant shutdown, that would probably all work out so that if the Savannah River reactor were down a year, it wouldn't matter, if all those things happened. Whereas, if you had some other combination, you would have to bring in some more material, bring it back from the stockpile. That means you'd have to work in DOD scenarios. That get's into another difficulty with operating strategies. It took us a long time to get feedback from the DOD on what they would do if they had to, what they call "mine" the stockpile for tritium. Obviously now, by 1990, they have learned how to do this. But in 1988, they really didn't want to do that. And we had to do our scenarios without a lot

of input from the DOD. We had to keep assuming that they would need the same amount, their demand curves did not always change based on what we told them were the uncertainties in our production complex. That evolved over time, over the last 2 years, between 88 and 89 that they started to get serious about realizing that they had to come up with some scenarios that assumed that we could not produce the material.

So we would go through a series of scenarios. Bob Galbo would be a really important person, and we would be running back and forth doing a lot of scenarios. And going up to talk to our management about what the options were. Because if we were assuming, for instance, that Rocky Flats was going to be shut down based on yet another incident of contamination, there would be a lot of nervousness about our making that assumption when it wasn't shutdown. I assumed that there was another contamination incident, but the plant is not shutdown yet. So we're projecting that it could get shutdown. So we would be working through getting the scenarios together and presenting them to upper management making a recommendation on how we should go, how we should try to protect ourselves, and how far out on a limb we would want to go in moving out on one of those alternate routes. Because otherwise, we could just say, all right, we're not going to produce from the Savannah River reactor for a year and that's it, everything else stays the same. But that wouldn't be a responsible way to do it. We would try to figure out how to best make up the material without having to change the demand, and then the next step would be if we couldn't do that, then how to work with the DOD to change the demand. But you're assuming that in 7 years we would run out, so there had to be some play between what you could stockpile and what you couldn't.

B.3.1.2 Translation

If the crossover point of all materials equals seven years then NMP needs the status of all reactors to be operating.
NMP needs all reactors operating in seven years.
The crossover point of all materials in seven years includes K-reactor and P-reactor at 100% power and L-reactor at 50% for seven years.
A disruption to the operating status of the reactors implies the date of the crossover point of all materials is less than seven years.
The Director of NMP considers actions to resolve the problem with the crossover point of all materials in seven years.
The Director of NMP inquires of someone the plan for the date of alternative supplies of plutonium exists is within seven years.
L-reactor power at 100% is an alternative source of plutonium.
If the Director of NMP resolves problems with L-reactor then L-reactor power could be 100%.
SIS is an alternative source of plutonium.
Before the status of SIS was shut down, SIS was an alternative source of plutonium.
The date of SIS operations was uncertain and L-reactor at 50% power imply a problem exists.
The impact of a reactor being shut down on NMP activities is severe.
If the status of reactor was shutdown is shut down, then someone is interested in cutting DOE's budget.
Arms limitation talks imply reducing the production of NMP.
The impact of arms limitation talks is date of the crossover point for all materials in the current supply/ demand cases equals ten years.
If the date of the crossover point for all materials is ten years, then alternatives for the supply nuclear materials could be operational.
The status of arms limitation talks is in the talking stage.
The proposed budget cut exists.
The attitude-of Congress and the attitude of the Public is don't spend money on production of nuclear

materials unless necessary.
If contamination at RFP exists, a bigger problem exists at RFP.
The status of RFP equals eminent shut down.
RFP shut down implies a reduction in demand for nuclear material.
RFP shut down implies the time period of demand for nuclear material is extended.
The Director of NMP inquires all about the reactor being shutdown.
The Director of NMP inquires of someone which reactor was shut down.
The Director of NMP inquires of someone the reason for the reactor being shut down.
The Director of NMP inquires of someone if the reason for shutting down the reactor was environmental safety.
The Director of NMP inquires of someone if the reason for shutting down the reactor was a mechanical problem.
The Director of NMP inquires of someone the time period of the reactor shut down.
The Director of NMP inquires of someone the plan for restart of the reactor that was shut down.
While the Director of NMP receives all the information about the reactor shut down, the Director of NMP decides how to deal with the media about the reactor was shut down.
The Director of NMP informs superiors about the reactor shut down.
The Director of NMP does not inform Congress about the reactor shut down.
If someone had made a press announcement about the reactor shut down, the Director of NMP would inform Congress all about the reactor shut down.
If a press announcement did not exist or the date of the press announcement was a couple of hours, the Director of NMP would wait for information about the reactor shut down before staff informed everyone about the reactor shutdown.
The staff informs everyone about the reactor shutdown.
The staff informs the Congress about the reactor shut down.
The staff informs the DOD about the reactor shut down.
The staff informs the OMB about the reactor shut down.
If who shut down the reactor is not oversight groups, then the staff informs oversight groups about the reactor shut down.
The Director of NMP inquires of someone the impact of the reason for the reactor shut down on the press announcement.
The date of the press announcement is immediately.
The time period of the Director of NMP determining the nature of the press announcement is not enough.
The press announcement includes the reactor was shut down and the reason for the reactor shut down.
If the time period of the reactor was shut down was unknown, the press announcement would include the time period of the reactor shut down is unknown.
If the reason for the reactor shut down is not a mechanical shutdown or a scram or something understood, then the Director of NMP investigates the reactor shut down.
The attitude of the Director of NMP about the reason for the reactor shut down is fairly paranoid.
The Director of NMP must understand the reason for the reactor shut down before the date of restarting the reactor was quickly.
If the date of restarting the reactor is not quickly and the time period of the reactor shut down is extended then the Director of NMP determines the time period of the reactor shut down.
The Director of NMP determines the impact of the time period of the reactor shut down on the supply of nuclear material.
The Director of NMP creates new supply/demand cases including the impact of the reactor shut down on the supply of nuclear material.
The Director of NMP understands the new supply/demand assumptions.
The new supply/demand assumptions include the status of RFP is operating, NMP's budget is adequate, the date of the impact of arms limitation talks on NMP activities is not immediately.
The date of the impact of signed treaties on NMP activities is more than seven years.

The Director of NMP evaluates the impact of arms limitation talks on NMP activities.
The Director of NMP inquires of someone the impact of arms limitation talks on NMP activities.
The time period of the reactor shut down is one year.
The reason for the reactor shut down is replacement of a major piece of equipment.
The time period of the reactor shut down of one year implies the value of SIS in none.
The Director of NMP considers the new supply/demand cases including the new supply/demand assumptions.
The Director of NMP considers the proposal to cut DOE's budget by 25%.
A 25% reduction in budget has a negative impact on the new supply/demand cases.
The cost of a shut down reactor equals the cost of an operating reactor.
The cost of a shut down reactor is greater than the cost of an operating reactor.
The reason for the cost of a shut down reactor being greater than the cost of an operating reactor is the cost of upgrades.
Based on the new supply/demand cases the Director of NMP prepares a strategic plan.
The time period of the strategic plan would be five years.
The strategic plan would include the reactor shut down.
The strategic plan would include several new supply/demand cases.
The new supply/demand cases would include the time period of the reactor shut down equals two years.
The Director of NMP inquires of someone If the time period of the reactor shut down is two years what alternative supplies of nuclear materials exist.
The production of L-reactor is plutonium.
The production of L-reactor is not tritium.
The Director of NMP considers the mix of nuclear material.
The Director of NMP considers the impact of the status of RFP on NMP activities.
The new supply/demand cases include the time period of RFP shut down of six months or more.
The Director of NMP inquires of someone the new supply/demand cases including RFP down for six months or more and the reactor shut down.
The Director of NMP inquires of someone the status of plutonium at all sites.
The Director of NMP inquires of someone the production of accelerated plutonium scrap processing at RL.
The Director of NMP inquires of someone the production of accelerated plutonium scrap processing at SR.
The Deputy Director of NMP informed the Director of NMP about one reactor being shut down.
The time period of the reactor shut down is one year.
The nature of the arms limitation talks is serious.
U.S.-Soviet agreements could be forthcoming.
The Director of NMP considers options for dealing with incidents.
The Director of NMP determines plans for dealing with options.
The reason for the options is to protect NMP activities regardless of the outcomes of the incidents.
Congress cuts NMP's budget by 25%, U.S.-Soviet agreements exist, and the status of RFP is shut down are incidents.
If incidents, then the impact of the time period of reactor shut down of one year is minimal on NMP activities.
If other incidents exist then the Director of NMP would have to find alternative supplies of nuclear material.
Alternative supplies of nuclear materials include accelerated returns from the stockpile.
The new stockpile cases would include accelerated returns from the stockpile.
The Director of NMP works with DOD to determine accelerated returns from the stockpile.
The number of new supply/demand cases is many.
The Director of NMP informs superiors all about the options for supply of nuclear material.
If the new supply/demand assumptions include the status of RFP will be shut down and the status of RFP is operating, the attitude of the superiors is nervous.
Contamination at RFP exists.
RFP is operating.
The status of RFP will equal shut down.
The Director of NMP prepares new supply/demand cases.

The Director of NMP informs superiors of the new supply/demand cases.
The Director of NMP recommends to superiors plan for NMP activities.
The Director of NMP recommends to superiors a plan for protecting NMP activities.
The Director of NMP recommends to superiors the risk of the options.
The impact of the reactor shut down for one year is no change in other NMP activities.
The quality of no change in other NMP activities is not responsible.
The Director of NMP minimizes the impact of the reactor shut down on the demand for nuclear material by finding alternative supplies for nuclear materials.
If the production of alternative supplies of nuclear materials is not sufficient then the Director of NMP works with DOD to change the demand for nuclear materials.

B.3.1.3 Coded Protocol

[IFTHEN:NEEDS |{EQUALS |'date-of'(Crossover point of all material), "seven years"|}, (Director of NMP), {EQUALS |'status-of'(All reactors), "operating"|}|]
[NEEDS |(Director of NMP), {EQUALS |'time-period-of',{EQUALS |'status-of'(All reactors), "operating"|}, "seven years"|}|]
{INCLUDES |(Current supply/demand cases), {EQUALS |'time-period-of',{EQUALS |'power-of'(K-reactor), AND 'power-of'(P-reactor), "100%"|}, AND 'time-period-of',{EQUALS |'power-of'(L-reactor), "50%"|}, "seven years"|}|}
{IMPLIES |[REDUCING |'power-of'(Reactor)|], {EQUALS |'date-of'(Crossover point of all material), "less than seven years"|}|}
[CONSIDERS |(Director of NMP), [RESOLVING |{EQUALS |'date-of'(Crossover point of all material), "seven years"|}|]|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'date-of',{EQUALS |'production-of'(Alternative supplies of plutonium), "meaningful quantities"|}, "within seven years"|}|]
{INCLUDES |(Alternative supplies of plutonium), {EQUALS |'power-of'(L-reactor), "100%"|}|}
{IFTHEN:EQUALS |[RESOLVES |(Director of NMP), {EQUALS |'reason-for'(L-reactor power loss), "environmental considerations"|}|], {EQUALS |'power-of'(L-reactor), "100%"|}|}
{INCLUDES |(Alternative supplies of plutonium), (SIS)|}
{BEFORE |{EQUALS |'status-of'(SIS), "shut down"|}, {INCLUDES |(Alternative supplies of plutonium), (SIS)|}|}
{IMPLIES |{EQUALS |'date-of',{EQUALS |'status-of'(SIS), "operating"|}, "uncertain"|}, AND {EQUALS |'power-of'(L-reactor), "50%"|}, (Bigger problem)|}
{EQUALS |'severity-of',{IMPACT |(Reactor was shut down), (NMP activities)|}, "severe"|}
[IFTHEN:WANTS |(Reactor was shut down), [CUT |(Someone), (DOEs current budget)|]|]
{IMPLIES |(Arms limitation talks), [REDUCING |(Supply of nuclear material)|]|}
{IMPACT |(Arms limitation talks), {EQUALS |'date-of'(Crossover point of all material), "ten years"|}|}
{IFTHEN:EQUALS |{EQUALS |'date-of'(Crossover point of all material), "ten years"|}, 'production-of'(Alternative supplies of nuclear material), "useful"|}
{EQUALS |'status-of'(Arms limitation talks), "talking stage"|}
{EQUALS |'existence-of'(Proposed budget cut), "exists"|}
{EQUALS |'attitude-of'(Congress), AND 'attitude-of'(Public), "dont spend money on production of nuclear materials unless necessary"|}
{IFTHEN:EQUALS |{EQUALS |'existence-of'(Contamination at RFP), "exists"|}, 'nature-of-problem'(RFP), "bigger problem"|}
{EQUALS |'status-of'(RFP), "eminent shut down"|}
{IMPLIES |{EQUALS |'status-of'(RFP), "shut down"|}, [REDUCE |(Demand for nuclear material)|]|}
{IMPLIES |{EQUALS |'status-of'(RFP), "shut down"|}, {EQUALS |'time-period-of'(Demand for nuclear

material), "extended"|}|]
[INQUIRES |(Director of NMP), (Someone), 'ALL'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), 'which'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), 'reason-for'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'reason-for'(Reactor was shut down), "environmental safety"|}|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'reason-for'(Reactor was shut down), "mechanical problem"|}|]
[INQUIRES |(Director of NMP), (Someone), 'time-period-of'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for-restart'(Reactor was shut down)|]
{WHILE |[RECEIVES |(Director of NMP), 'ALL'(Reactor was shut down)|], [DECIDES |(Director of NMP), (Plan for dealing with the media), (Reactor was shut down)|]|}
[INFORMS |(Director of NMP), (Superiors), 'ALL'(Reactor was shut down)|]
[DOESNOTINFORM |(Director of NMP), (Congress), 'ALL'(Reactor was shut down)|]
[IFTHEN:INFORMS |[RELEASED |(Someone), (Press announcement), 'ALL'(Reactor was shut down)|], (Director of NMP), (Congress), 'ALL'(Reactor was shut down)|]
[IFTHEN:WAITBEFORE |{EQUALS |'existence-of'(Press announcement), "dont exist"|}, OR {EQUALS |'date-of'(Press announcement), "couple of hours"|}, 'ALL'(Reactor was shut down), [INFORMS |(Staff), (Everyone), 'ALL'(Reactor was shut down)|]|]
[INFORMS |(Staff), (Everyone), 'ALL'(Reactor was shut down)|]
[INFORMS |(Staff), (Congress), 'ALL'(Reactor was shut down)|]
[INFORMS |(Staff), (DOD), 'ALL'(Reactor was shut down)|]
[INFORMS |(Staff), (OMB), 'ALL'(Reactor was shut down)|]
[IFTHEN:INFORMS |{NOTEQUALS |'who'(Reactor was shut down), (Oversight groups)|}, (Staff), (Oversight groups), 'ALL'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), {IMPACT |'reason-for'(Reactor was shut down), 'nature-of'(Press announcement)|}|]
{EQUALS |'date-of'(Press announcement), "immediately"|}
{EQUALS |'time-period-of',[DETERMINES |(Director of NMP), 'nature-of'(Press announcement)|], "not enough time"|}
{INCLUDES |(Press announcement), (Reactor was shut down), AND 'reason-for'(Reactor was shut down)|}
{IFTHEN:INCLUDES |{EQUALS |'time-period-of'(Reactor was shut down), "unknown"|}, (Press announcement), {EQUALS |'time-period-of'(Reactor was shut down), "unknown"|}|}
[IFTHEN:INVESTIGATES |{NOTEQUALS |'reason-for'(Reactor was shut down), "mechanical shutdown", OR "scram", OR "something understood"|}, (Director of NMP), (Reactor was shut down)|]
{EQUALS |'attitude-of'(Director of NMP), 'reason-for'(Reactor was shut down), "fairly paranoid"|}
{BEFORE |[UNDERSTAND |(Director of NMP), 'reason-for'(Reactor was shut down)|], {EQUALS |'date-of',[RESART |(Reactor was shut down)|], "quickly"|}|}
[IFTHEN:DETERMINES |{NOTEQUAL |'date-of',[RESTART |(Reactor was shut down)|], "quickly"|}, AND {EQUALS |'time-period-of'(Reactor was shut down), "extended"|}, 'time-period-of'(Reactor was shut down)|]
[DETERMINES |(Director of NMP), {IMPACT |'time-period-of'(Reactor was shut down), (Supply of nuclear material)|}|]
[CREATES |(Director of NMP), {INCLUDES |(New supply/demand cases), {IMPACT |(Reactor was shut down), (Supply of nuclear material)|}|}|]
[UNDERSTAND |(Director of NMP), (New supply/demand assumptions)|]
{INCLUDE |(New supply/demand assumptions), {EQUALS |'status-of'(RFP), "operating"|}, {EQUALS |'adequacy-of'(NMPs current budget), "adequate"|}, AND {EQUALS |'date-of',{IMPACT |(Arms limitation talks), (NMP activities)|}, "not immediately"|}|}
{EQUALS |'date-of',{IMPACT |(Signed treaties), (NMP activities)|}, "more than seven years"|}
[EVALUATES |(Director of NMP), {IMPACT |(Arms limitation talks), (NMP activities)|}|]

[INQUIRES |(Director of NMP), (Someone), {IMPACT |(Arms limitation talks), (NMP activities)|}|]
{EQUALS |'time-period-of'(Reactor was shut down), "one year"|}
{EQUALS |'reason-for'(Reactor was shut down), "replacement of a major piece of equipment"|}
{IMPLIES |{EQUALS |'time-period-of'(Reactor was shut down), "one year"|}, {EQUALS |'value-of'(SIS), "none"|}|}
[CONSIDERS |(Director of NMP), {INCLUDES |(New supply/demand cases), (New supply/demand assumptions)|}|]
[CONSIDERS |(Director of NMP), (Proposal to cut DOEs current budget by 25%)|]
{NEGATIVEIMPACT |[REDUCING |(Congress), (NMPs current budget), "By-25%"|], (New supply/demand cases)|}
{EQUALS |'cost-of',{EQUALS |'status-of'(Reactor), "shut down"|}, 'cost-of',{EQUALS |'status-of'(Reactor), "operating"|}|}
{GREATERTHAN |'cost-of',{EQUALS |'status-of'(Reactor), "shut down"|}, 'cost-of',{EQUALS |'status-of'(Reactor), "operating"|}|}
{EQUALS |'reason-for',{GREATERTHAN |'cost-of',{EQUALS |'status-of'(Reactor), "shut down"|}, 'cost-of',{EQUALS |'status-of'(Reactor), "operating"|}|}, 'cost-of'(Upgrades)|}
[PREPARES |(Director of NMP), {INCLUDES |(Strategic plan), (New supply/demand cases)|}|]
{EQUALS |'time-period-of'(Strategic plan), "five years"|}
{INCLUDES |(Strategic plan), (Reactor was shut down)|}
{INCLUDES |(Strategic plan), {EQUALS |'number-of'(New supply/demand cases), "several"|}|}
{INCLUDE |(New supply/demand cases), {EQUALS |'time-period-of'(Reactor was shut down), "two years"|}|}
[INQUIRES |(Director of NMP), (Someone), {IFTHEN:EQUALS |{EQUALS |'time-period-of'(Reactor was shut down), "two years"|}, (Alternative supplies of nuclear material)|}|]
{EQUALS |'production-of'(L-reactor), "plutonium"|}
{NOTEQUALS |'production-of'(L-reactor), "tritium"|}
[CONSIDERS |(Director of NMP), (Mix of nuclear material required)|]
[CONSIDERS |(Director of NMP), {IMPACT |'status-of'(RFP), (NMP activities)|}|]
{INCLUDE |(New supply/demand cases), {EQUALS |'time-period-of',{EQUALS |'status-of'(RFP), "shut down"|}, "six months or more"|}|}
[INQUIRES |(Director of NMP), (Someone), {INCLUDE |(New supply/demand cases), {EQUALS |'time-period-of',{EQUALS |'status-of'(RFP), "shut down"|}, "six months or more"|}, AND (Reactor was shut down)|}|]
[INQUIRES |(Director of NMP), (Someone), 'status-of',{OWNS |(All sites), (Plutonium)|}|]
[INQUIRES |(Director of NMP), (Someone), 'production-of',{OWNS |(RL), (Accelerated plutonium scrap processing)|}|]
[INQUIRES |(Director of NMP), (Someone), 'production-of',{OWNS |(SR), (Accelerated plutonium scrap processing)|}|]
[INFORMS |(Deputy Director of NMP), (Director of NMP), (Reactor was shut down)|]
{EQUALS |'time-period-of'(Reactor was shut down), "one year"|}
{EQUALS |'nature-of'(Arms limitation talks), "serious"|}
{EQUALS |'potential-for'(U.S.-Soviet agreements), "likely"|}
[CONSIDERS |(Director of NMP), (Options for dealing with incidents)|]
[DETERMINES |(Director of NMP), 'plan-for'(Options for dealing with incidents)|]
{EQUALS |'reason-for'(Options for dealing with incidents), [PROTECT |(Director of NMP), (NMP activities), "regardless of the outcomes of the incidents"|]|}
{INCLUDES |(Incidents), [CUTS |(Congress), (NMPs current budget), "By-25%"|], {EQUALS |'existence-of'(U.S.-Soviet agreements), "exists"|}, AND {EQUALS |'status-of'(RFP), "shut down"|}|}
{IFTHEN:IMPACTEQUALS |{EQUALS |'existence-of'(Incidents), "exists"|}, {EQUALS |'time-period-of'(Reactor was shut down), "one year"|}, (NMP activities), "minimal"|}
[IFTHEN:FIND |{EQUALS |'existence-of'(Other incidents), "exists"|}, (Director of NMP), (Alternative

supplies of nuclear material)|]
{INCLUDE |(Alternative supplies of nuclear material), (Accelerated returns from the stockpile)|}
{INCLUDES |(New stockpile cases), (Accelerated returns from the stockpile)|}
[WORKSWITH |(Director of NMP), (DOD), [DETERMINE |(Accelerated returns from the stockpile)|]|]
{EQUALS |'number-of'(New supply/demand cases), "many"|}
[INFORMS |(Director of NMP), (Superiors), 'ALL'(Alternative supplies of nuclear material)|]
{IFTHEN:EQUALS |{INCLUDES |(New supply/demand assumptions), {WILLEQUAL |'status-of'(RFP), "shut down"|}, AND {EQUALS |'status-of'(RFP), "operating"|}|}, 'attitude-of'(Superiors), "nervous"|}
{EQUALS |'existence-of'(Contamination at RFP), "exists"|}
{EQUALS |'status-of'(RFP), "operating"|}
{WILLEQUAL |'status-of'(RFP), "shut down"|}
[PREPARES |(Director of NMP), (New supply/demand cases)|]
[INFORMS |(Director of NMP), (Superiors), (New supply/demand cases)|]
[RECOMMENDS |(Director of NMP), (Superiors), 'plan-for'(NMP activities)|]
[RECOMMENDS |(Director of NMP), (Superiors), 'plan-for',[PROTECT |(Director of NMP), (NMP activities)|]|]
[RECOMMENDS |(Director of NMP), (Superiors), 'risk-of'(Options for dealing with incidents)|]
{NOIMPACT |{EQUALS |'time-period-of'(Reactor was shut down), "one year"|}, (Other NMP activities)|}
{EQUALS |'quality-of',{NOIMPACT |{EQUALS |'time-period-of'(Reactor was shut down), "one year"|}, (Other NMP activities)|}, "not responsible"|}
[MINIMIZESBY |(Director of NMP), {IMPACT |(Reactor was shut down), (Demand for nuclear material)|}, [FINDING |(Director of NMP), (Alternative supplies of nuclear material)|]|]
[IFTHEN:WORKSWITH |{EQUALS |'production-of'(Alternative supplies of nuclear material), "not sufficient"|}, (Director of NMP), (DOE), [CHANGE |(Demand for nuclear material)|]|]

B.3.2 Subject 3, Exercise 2

B.3.2.1 Transcript

I think the first issue is that we need, even though we have an agreement to reduce the number of nuclear weapons in Europe, the bulk of the stockpile is not in Europe. In fact, we've reduced the number of weapons in Europe several times. We will still need to have those reactors, at least P and L, operating and we probably need to have all three reactors available because you can't depend on them; they're old.
And, the scenario looks like Rocky Flats is getting closer to being shutdown, but they still haven't shutdown the plant. They've just seized the plant. That's interesting. The FBI took over the plant and secured all the files. But I would not imagine that they took over operation of the plant so that we couldn't operate it. Because in reality they did that, but then we started the plant and we operated the plant anyway for a while before we decided to shut it down.
The immediate problem is the confidence in the reactors that are still operating because if there's a memo in the files that says the safety analysis is inadequate by today's standard. The immediate problem is why are you still operating P and L reactors. Why aren't they being shut down? And then there would be spillover to operating other facilities, because if these safety analyses weren't adequate, there may be others that aren't also. But your immediate problem is to deal with the P and L reactors,

the implication that P and L are running without having adequate safety analyses. I think we need to make a decision on whether we should shut the other two reactors down. I would not shut them down based on a Washington Post article that says they have an internal DOE contractor memorandum stating that. But I would take it very seriously. I would try to find out quickly what the status was of those safety analyses. Who had reviewed them? Get some experts in on safety analysis work. And make a decision whether we should continue operating P and L reactors. Also find out how long it would take to upgrade the safety analyses to today's standard. And make a decision on whether we should shut down the other two reactors down until the safety analyses were upgraded. And in doing that, we could factor in other conditions. I'd have a little trouble with this, because I would say we shouldn't factor in at all whether the Rocky Flats Plant were going to get shut down, or whether they were reducing the number of weapons in Europe. If we didn't have adequate safety analyses for the reactors, if they were serious flawed, the reactors shouldn't operate regardless of what the need was. But on the other hand, there is some point at which you balance the national security need against the risk of running a reactor without adequate safety analysis. But that's what you would have to find out first. How bad was the situation with the safety analyses? If it were bad enough, the reactors should get shutdown while you were thinking further about it. Then you could decide whether you were going to start them up again. Of course, (and I remember this from the real world) there's a tremendously more difficult problem in starting a facility that's shutdown versus continuing to operate a facility that has had some questions raised on it. But the first thing I would do is to find out what the situation was. And we would have to get experts in, because Nuclear Materials Production staff would not be in a position to give me a very good picture of that. We'd probably have to get people from Los Alamos in, or SAIC, some of the support contractors who are very familiar with reactor safety and go down to Savannah River and look over the situation with them and have them explain where they are with their safety analysis. We'd get EH--at that time that's where the expertise was. We would get them involved and have them go down with us and see what the situation is. And then depending on what that was like, we would either shutdown the reactors or not. And then we'd go from there to decide how long we would have them shut down.

B.3.2.2 Translation

An agreement to reduce the number of nuclear weapons in Europe exists.
Since the location of the bulk of the number of weapons is not in Europe the Director of NMP needs all reactors operating.
The number of times the executive branch has reduced the number of nuclear weapons in Europe is several times.
The Director of NMP needs P-reactor operating and L-reactor operating.
Because the reactors are old and undependable, the Director of NMP needs three reactors available.
The status of RFP is closer to being shut down.
The status of RFP is opertaing.
The FBI seized the Rocky Flats Plant.
The level of interest of the Director of NMP in the FBI seized the Rocky Flats Plant is interested.
The FBI seized the Rocky Flats Plant.
The FBI secured all the files at the Rocky Flats Plant.
The Director of NMP does not believe the FBI shut down Rocky Flats Plant.
The FBI seized the Rocky Flats Plant.
The status of RFP was operating.
The status of RFP was operating before DOE shut down RFP.
The problem is confidence in the status of the other reactors being operating.
If an internal DOE contractor memo about safety analyses exists the problem is the status of P-reactor and L-

reactor being operating.
The Director of NMP inquires of someone why the status of P-reactor and L-reactor is not equal to shut down.
The internal DOE contractor memo about safety analyses impacts other facilities that are operating.
If the adequacy of the reactor safety analyses is inadequate, then other safety analyses are inadequate.
The problem is for the Director of NMP to deal with the confidence in the status of P and L reactors being operating and the adequacy of reactor safety analyses being inadequate.
If the reactor safety analyses are inadequate, the Director of NMP needs to decide on shutting down P and L reactors.
Based on the Washington Post publishing an article on safety analyses, the Director of NMP would not shut down P and L reactors.
The interest of the Director of NMP in the article on reactor safety analyses is serious.
The Director of NMP inquires quickly the status of reactor safety analyses.
The Director of NMP inquires of someone who reviewed the reactor safety analyses.
The Director of NMP requests assistance from experts on reactor safety analyses.
The Director of NMP decides the status of P and L reactors being operating.
The Director of NMP inquires of someone the time period of upgrading the reactor safety analyses where the status of the analyses equals up to today's standards.
The Director of NMP decides to shut down all reactors until the status of upgrading the reactor safety analyses is complete.
The status of RFP being shut down and reducing the number of nuclear weapons in Europe have no impact on the status of the reactors.
If the reactor safety analyses are inadequate and if the reactor safety analyses are seriously flawed then the Director of NMP should shut down all the reactors.
The Director of NMP must balance NMP's ability to meet national security requirements against the risk of operating the reactors with inadequate safety analyses.
The Director of NMP inquires of someone the severity of reactor safety analyses.
If the severity of the reactor safety analyses is bad enough, the Director of NMP shuts down all reactors.
The Director of NMP decides restarting the reactors.
It is more difficult to restart a facility that's shut down than to continue operating a facility with questions about the facility.
The Director of NMP inquires of someone all about reactor safety analyses.
Because staff is not capable of providing assistance on reactor safety analyses, the Director of NMP requests assistance from experts on reactor safety analyses.
The Director of NMP requests assistance from Los Alamos National Laboratories, SAIC, and support contractors on reactor safety analyses.
The Director of NMP and the experts go to SR to evaluate reactor safety analyses.
The Director of NMP inquires of SR the status of reactor safety analyses.
The expertise of EH includes reactor safety analyses.
The Director of NMP works with EH on reactor safety analyses.
The Director of NMP and EH go to SR to evaluate reactor safety analyses.
The status of the reactors depends on the status of reactor safety analyses.
The Director of NMP determines the time period of the reactors being shut down.

B.3.2.3 Coded Protocol

{EQUALS l'existence-of'(Agreement to reduce the number of nuclear weapons in Europe), "exists"l}
[BECAUSE:NEEDS l{NOTEQUALS l'location-of',{EQUAL l'number-of'(Nuclear weapons), "bulk"l}, "Europe"l}, (Director of NMP), {EQUALS l'status-of'(All reactors), "operating"l}l]
{EQUALS l'number-of', [REDUCE l(Executive Branch), 'number-of',{EQUALS l'location-of'(Nuclear

weapons), "Europe"|}, "several times"|]|}
[NEEDS |(Director of NMP), {EQUALS l'status-of'(P-reactor), "operating"|}, AND {EQUALS l'status-of'(L-reactor), "operating"|}|]
[BECAUSE:NEEDS |{EQUALS l'age-of'(All reactors), "old"|}, AND {EQUALS l'reliability-of'(All reactors), "undependable"|}, (Director of NMP), {EQUALS l'status-of'(All reactors), "available"|}|]
{EQUALS l'status-of'(RFP), "closer to being shut down"|}
{EQUALS l'status-of'(RFP), "operating"|}
[SEIZED |(FBI), (RFP)|]
{EQUALS l'level-of-interest'(Director of NMP), [SEIZED |(FBI), (RFP)|], "interested"|}
[SEIZED |(FBI), (RFP)|]
[SECURED |(FBI), 'files-of'(RFP)|]
[DOESNOTBELIEVE |(Director of NMP), [SHUTDOWN |(FBI), (RFP)|]|]
[SEIZED |(FBI), (RFP)|]
{WASEQUAL l'status-of'(RFP), "operating"|}
{BEFORE |{WASEQUAL l'status-of'(RFP), "operating"|}, [SHUTDOWN |(DOE), (RFP)|]|}
{EQUALS |(Problem), 'confidence-in',{EQUALS l'status-of'(Other reactors), "operating"|}|}
{IFTHEN:EQUALS |{EQUALS l'existence-of'(Internal DOE contractor memo about safety analyses), "exists"|}, (Problem), {EQUALS l'status-of'(P-reactor), "operating"|}, AND {EQUALS l'status-of'(L-reactor), "operating"|}|}
[INQUIRES |(Director of NMP), (Someone), 'reason-for',{EQUALS l'status-of'(P-reactor), "operating"|}, AND 'reason-for',{EQUALS l'status-of'(L-reactor), "operating"|}|]
{IMPACTS |{EQUALS l'existence-of'(Internal DOE contractor memo about safety analyses), "exists"|}, {EQUALS l'status-of'(Other facilities), "operating"|}|}
{IMPLIES |{EQUALS l'adequacy-of'(Reactor safety analyses), "inadequate"|}, {EQUALS l'adequacy-of'(Safety analyses of other facilities), "inadequate"|}|}
{EQUALS |(Problem), [DEALWITH |(Director of NMP), 'confidence-in',{EQUALS l'status-of'(P-reactor), "operating"|}, 'confidence-in',{EQUALS l'status-of'(L-reactor), "operating"|}, AND {EQUALS l'adequacy-of'(Reactor safety analyses), "inadequate"|}|]|}
[IFTHEN:DECIDES |{EQUALS l'adequacy-of'(Reactor safety analyses), "inadequate"|}, (Director of NMP), [SHUTDOWN |(Director of NMP), (P-reactor), AND (L-reactor)|]|]
[BECAUSE:NOTSHUTDOWN |[PUBLISHED |(The Washington Post), (Article on another incident of contamination at Rocky Flats)|], [NOTSHUTDOWN |(Director of NMP), (P-reactor), AND (L-reactor)|]|]
{EQUALS l'level-of-interest'(Director of NMP), (Article on another incident of contamination at Rocky Flats), "serious"|}
{EQUALS l'date-of',[INQUIRES |(Director of NMP), (Someone), 'status-of'(Reactor safety analyses)|], "quickly"|}
[INQUIRES |(Director of NMP), (Someone), 'who-reviewed'(Reactor safety analyses)|]
[REQUESTSASSISTANCE |(Director of NMP), (Experts), (Reactor safety analyses)|]
[DECIDES |(Director of NMP), {EQUALS l'status-of'(P-reactor), "operating"|}, AND {EQUALS l'status-of'(L-reactor), "operating"|}|]
[INQUIRES |(Director of NMP), (Someone), 'time-period-of',[UPGRADES |(Reactor safety analyses), {EQUALS l'status-of'(Reactor safety analyses), "todays standards"|}|]|]
[DECIDES |(Director of NMP), {EQUALS l'time-period-of',{EQUALS l'status-of'(All reactors), "shut down"|}, 'time-period-of',{EQUALS l'status-of',[UPGRADES |(Reactor safety analyses)|], "in process"|}|}|]
{NOIMPACT |{EQUALS l'status-of'(RFP), "closer to shut down"|}, AND {EQUALS l'existence-of'(Agreement to reduce the number of nuclear weapons in Europe), "exists"|}, 'status-of'(All reactors)|}
[IFTHEN:SHUTDOWN |{EQUALS l'adequacy-of'(Reactor safety analyses), "inadequate"|}, AND {EQUALS l'nature-of'(Reactor safety analyses), "seriously flawed"|}, (Director of NMP), (All

reactors)|]
[BALANCE |(Director of NMP), (NMPs ability to meet national security requirements), 'risk-of',[OPERATINGWITH |(All reactors), {EQUALS |'adequacy-of'(Reactor safety analyses), "inadequate"|}|]|]
[INQUIRES |(Director of NMP), (Someone), 'severity-of'(Reactor safety analyses)|]
[IFTHEN:SHUTDOWN |{EQUALS |'severity-of'(Reactor safety analyses), "severe enough"|}, (Director of NMP), (All reactors)|]
[DECIDES |(Director of NMP), [RESTART |(Director of NMP) (All reactors)|]|]
{MOREDIFFICULT |[RESTART |{EQUALS |'status-of'(Facility), "shut down"|}|], [CONTINUEOPERATINGWITH |(Facility), (Questions about the facility)|]|}
[INQUIRES |(Director of NMP), (Someone), 'ALL'(Reactor safety analyses)|]
[BECAUSE:REQUESTSASSISTANCE |{NOTINCLUDES |'capability-of'(Staff), (Reactor safety analyses)|}, (Director of NMP), (Experts), (Reactor safety analyses)|]
[REQUESTSASSISTANCE |(Director of NMP), (LLNL), (SAIC), AND (Support contractors), (Reactor safety analyses)|]
[GOTO |(Director of NMP), AND (Experts), (SR), [EVALUATE |(Reactor safety analyses)|]|]
[INQUIRES |(Director of NMP), (SR), 'status-of'(Reactor safety analyses)|]
{INCLUDES |'capability-of'(EH), (Reactor safety analyses)|}
[WORKSWITH |(Director of NMP), (EH), (Reactor safety analyses)|]
[GOTO |(Director of NMP), AND (EH), (SR), [EVALUATE |(Reactor safety analyses)|]|]
{DEPENDSON |'status-of'(All reactors), 'status-of'(Reactor safety analyses)|}
[DETERMINES |(Director of NMP), 'time-period-of',{EQUALS |'status-of'(All reactors), "shut down"|}|]

B.3.3 Subject 3, Exercise 3

B.3.3.1 Transcript

I think whether there's a reorganization or not, the people who know the information are still going to be there in some form or another. If all the reactors are down, I will make an assumption that we are basically in the situation that we ended up with. That we have the reactors down for a major upgrade program that's going to take several years. And that, so there's no tritium being produced. No new plutonium being produced. That the shipments from Fernald, stopped all shipments of nuclear materials through the state. What's going through Ohio. I don't know if anything else goes through Ohio, but I'll assume the only thing is the Fernald shipment.
The question is what's the decision that's needed here. Military Application is unhappy because we're not able to meet the peg points. We've got reactors down at Savannah River. We've got Fernald looks like it's on its way down. I would say that the decision that needs to be made here is how we're going to deal with this, as an organization, how are we going to get through this period of time that we have here, understanding what the supply and demand is and what we can do and what we can't do and how we can work together on this. So the decision is how to approach this problem, I think, from an organizational standpoint and from a planning, strategic planning standpoint right now. Especially since there is a rumor of a reorganization. Because if, I'd say we'd be in a best position to serve, wherever we're going to be, if we really understood what the facts are and where, and we had all the data. So regardles of how it gets reorganized, we're going to have the information available that we need as we go through this process here.

I will assume that the Department, well I'll make an initial decision. The initial decision is what to do about the governor of Ohio stopping the shipments out of Fernald, in to and out of Fernald. And whether we on our own would want to shut down Fernald over this leak from one of the tanks. So there are a lot of things going on here.

On the short term decision of how to deal with Fernald, I would ask for information on what, I would try to get the information on what is the materials coming out of Fernald? How important is it? Do we need it? And then on the, it says last week there was a leak from one of the tanks, so I will make the assumption that we didn't take any action from that because it's last week already and they're still operating. So that I'll assume that it wasn't all that serious. But it's just another, kind of another nail in the coffin that Fernald is perceived to be in bad shape. There's another piece of evidence that if we continue operating it, we're going to have continued problems with it.

If all the reactors are shut down at Savannah River, that means we're not making any plutonium at Savannah River, that means we don't need any depleted uranium from Fernald. I would go through a similar process of finding out whether we need Fernald. To make the decision of are we going to go confront the governor or not. Is this really serious? I mean if the governor of Colorado said he wasn't going to allow any plutonium in to or out of Rocky Flats, there would be, the first thing you would do is go talk to the General Council about what we were going to do about this. Because, I think the Department would have to make a policy decision on how we were going to deal with the governor's stopping shipments as a hostage kind of a situation. Now we know that, in effect, Andress did this. And we have told him that we looked into what the government's authorities were. And the fact is we did not try to override, we made a decision to override him on this, but to try to work with the situation without going into court. Actually we wouldn't go into court. We would probably just ship and he would go into court to try to stop us. But in any case, that the decision, I think one of the important things about the decision on whether we would, how we would deal with the Fernald situation would be, number one, how important Fernald was to us. On the assumption we didn't on our own want to shut Fernald down. I would say there's a leak from one of the tanks, I would first have to decide whether there's anything new at Fernald to reassess that question that we had last week about whether we should shut down Fernald. Is there anything new that I've found out since? So I would ask for that information, then how much do we need the material from Fernald? And I already have an idea of that considering we don't need to produce plutonium at Savannah River, can't produce plutonium at Savannah River at least for now. So I would again review, the reactors are down for how long? What's the supply/demand situation that the Military Applications people are looking at? How much reserve do we have of material that we do need because there are other aspects of the supply from Fernald. We have supply that's needed to Y-12 for weapons parts and to Rocky. So that would be the other question of what's the supply and demand situation. Do we need to ship from Fernald at all? Or do we have enough material at Y-12 to continue to produce weapons in the interim? And I would work this with Military Application, which is something interesting I didn't say before. But considering how unhappy they are with the fact that we can't produce enough to meet peg points, I think it would be very important that they be with us as we go through this process of deciding whether or not we're going to confront the governor of Ohio and whether or not we're going to do anything, well first, about shutting down Fernald on our own, and then about preventing the governor from shutting it down.

And I will assume, if we get all that information and we see that the Fernald material isn't critical that we could go through another six months or so without having a problem with this. Then we would make a decision whether we would want to go after the governor just as a matter of principle or not.

This is interesting. This is the second time I think I'm going to come to a decision to delay the decision. But especially this one of confronting a governor on the shipments, that would be a difficult decision to make and one that we would probably hesitate before making.

And the reactors being down at Savannah River, I think, is a longer-term problem that we need to get together, so the first one is Fernald, but now the other piece of information I have that the reactors are now all down at Savannah River, I think we've got an organizational problem here that the Military Application people either don't understand or don't appreciate what's happening with the reactors,

don't think we're doing a good enough job dealing with it. And I would ask that we work, that we get something together to work with them to review the situation at Savannah River, so that we are confident that keeping the reactors down, for instance, is the right thing to do. When we review the supply/demand situation again, the national security implications that go to the DOD. We'd go through that process again, but with Military Application to make this a joint decision instead of making this, what appears to be the case, is that we decided to shut down the Savannah River reactors. Military Application either thinks we are not working hard to bring it up, not working hard enough, to bring them up, or that the national security situation has changed such that we should do something inspite of the fact that they're not ready. So that's what I would do. I would attack the Fernald situation first. And the second, attack this issue of reorganization and the Military Application people being unhappy about how we're dealing with it.

B.3.3.2 Translation

After the Secretary of Energy reorganizes DOE, the status of people who know the information will equal employed.
If all the reactors are down, then the reason for the reactors being down is a major upgrade program.
The time period of the major upgrade program is several years.
The production of NMP includes no new tritium.
The production of NMP includes no new plutonium.
The governor of Ohio stopped shipments of nuclear materials through the state of Ohio.
The Director of NMP inquires of someone what nuclear materials are shipped through Ohio.
The Director of NMP does not know of nuclear materials shipped through Ohio other than nuclear materials from FMPC.
The nuclear materials shipped through Ohio equals nuclear materials from FMPC.
The Director of NMP considers deciding on something.
The reason for the DAS/MA expressing displeasure was not being able to produce enough material to meet peg points.
The status of SR reactors is shut down.
The status of FMPC is closer to shut down.
The Director of NMP considers NMP dealing with incidents.
NMP must understand all about the current supply/demand cases.
NMP must understand all about options for dealing with incidents.
The Director of NMP works with staff on options for dealing with the incidents.
The decision is plan for options for dealing with the incidents.
Because of the rumor of plans for reorganization of DOE, the perspective of the plan for options for dealing with the incidents is organizational and strategic planning.
The Director of NMP must understand all about the incidents.
The Director of NMP must have all the information about the incidents.
The Director of NMP decides about the governor of Ohio stopping all shipments of nuclear materials through the state.
The Director of NMP decides if the leak from one of the tanks at FMPC implies the Director of NMP shuts down FMPC.
The Director of NMP inquires of someone what material FMPC ships.
The Director of NMP inquires of someone the importance of what material FMPC ships.
The Director of NMP inquires of someone the need for what material FMPC ships.
Since the date of the leak from one of the tanks at FMPC is last week and FMPC is still operating then the Director of NMP did not act on the leak from one of the tanks at FMPC.
The severity of the leak from one of the tanks at FMPC is not severe.

The leak from one of the tanks at FMPC contributes to the perception about FMPC being negative.
If the status of FMPC continues to be operating then problems at FMPC will continue.
The status of all rectors being shut down implies the production of NMP is no new plutonium which implies the Director of NMP does not need depleted uranium from FMPC.
The Director of NMP determines the status of FMPC.
The need for FMPC impacts the decision to confront the governor of Ohio.
The Director of NMP inquires of someone if the severity of the governor of Ohio stopping shipments is serious.
If the governor of Colorado stopped the material flow of RFP, the Director of NMP would talk to the General Council about the legality of the governor of Colorado stopping the material flow.
The nature of DOE deciding about the nature of the governor stopping shipments being a hostage-type situation is policy.
The governor of Ohio stopped all shipmentsof nuclear materials through the state.
The DOE informed the governor of Ohio about the legality of the governor stopping shipments.
The DOE decided not to override the governor of Ohio.
The DOE decided to work with the governor of Ohio out of court.
The DOE would not go to court.
The DOE would ship nuclear material.
The governor of Ohio would go to court to stop DOE from shipping nuclear material.
The priority of dealing with FMPC is first.
The Director of NMP inquires of someone the importance of what material FMPC ships.
The Director of NMP doesn't want to shut down FMPC.
There exists a leak from one of the tanks at FMPC.
The Director of NMP inquires of someone all about FMPC.
The Director of NMP evaluates shutting down FMPC.
The Director of NMP inquires of someone if there is any new information about FMPC.
The Director of NMP inquires of someone the importance of what material FMPC ships.
The production of NMP being no new plutonium implies the importance of what material FMPC ships is minimal.
The Director of NMP inquires of someone the time period of all the reactors being shut down.
The Director of NMP inquires of someone all about the new supply/demand cases including the new demand cases.
The Director of NMP inquires about the inventories of what material FMPC ships.
The FMPC provides nuclear material to Y-12 and to RFP.
The Director of NMP inquires of someone the need for what material FMPC ships.
The Director of NMP inquires of someone the time period of inventory of what material FMPC ships at Y-12.
The Director of NMP works with DAS/MA on the governor stopping shipments of nuclear materials through the state.
The attitude of DAS/MA about NMP being unhappy implies it is important for the Director of NMP works with DAS/MA on the governor stopping shipments of nuclear material through the state.
The Director of NMP works with DAS/MA on shutting down FMPC.
The Director of NMP works with DAS/MA to prevent the governor of Ohio from shutting down FMPC.
If the need for the material from FMPC is not critical then the time period of stopping shipments could be six months.
The Director of NMP decides the nature of confronting the governor of Ohio as a matter of principle.
The Director of NMP decides to delay deciding to confront the governor of Ohio.
The nature of deciding to confront of the governor of Ohio is difficult.
The Director of NMP waits before deciding to confront the governor of Ohio.
The nature of all the reactors being shut down is a long-term problem.
The status of all the reactors is shut down.
The nature of the problem is organizational.

DAS/MA does not understand the nature of the status of the reactors being shut down.
DAS/MA doesn't believe the quality of NMP activities equals good enough.
The Director of NMP works with DAS/MA to evaluate the status of the reactors being shut down.
Evaluating the status of the reactors being shut down impacts the confidence of NMP in the status of the reactors.
The Director of NMP works with DAS/MA to evaluate the new supply/demand cases.
The Director of NMP works with DAS/MA to evaluate the impact of the new supply/demand cases on the national security.
DAS/MA believes the adequacy of NMP activities is not enough.
DAS/MA believes the change in the national security implies restarting the reactors even though the status of the reactors is not ready.
The Director of NMP attacks the situation at FMPC.
The Director of NMP attacks the plan for reorganizing DOE and the attitude of DAS/MA.

B.3.3.3 Coded Protocol

{AFTER:EQUALS |[REORGANIZES |(Secretary of Energy), (DOE)|], 'status-of'(People who know the information), "employeed"|}
{IFTHEN :EQUALS |{EQUALS |'status-of'(All reactors), "shut down"|}, 'reason-for',{EQUALS |'status-of'(All reactors), "shut down"|}, {EQUALS |'existence-of'(Major upgrade program), "exists"|}|}
{EQUALS |'time-period-of'(Major upgrade program), "several years"|}
{INCLUDES |'production-of'(NMP), "no new tritium"|}
{INCLUDES |'production-of'(NMP), "no new plutonium"|}
[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]
[INQUIRES |(Director of NMP), (Someone), 'what',{INCLUDES |'shipping-of'(Nuclear material), "through Ohio"|}|]
[DOESNOTKNOW:OTHERTHAN |(Director of NMP), 'what',{INCLUDES |'shipping-of'(Nuclear material), "through Ohio"|}, (Nuclear material at FMPC)|]
{EQUALS |'what',{INCLUDES |'shipping-of'(Nuclear material), "through Ohio"|}, (Nuclear material at FMPC)|}
[CONSIDERS |(Director of NMP), [DECIDING |(Director of NMP), (Something)|]|]
{EQUALS |'reason-for',[EXPRESSEDDISPLEASURE |(DAS/MA), (Director of NMP)|], "not being able to produce enough material to meet peg points"|}
{EQUALS |'status-of'(SR reactors), "shut down"|}
{EQUALS |'status-of'(FMPC), "closer to shut down"|}
[CONSIDERS |(Director of NMP), [DEALINGWITH |(Director of NMP), (Incidents)|]|]
[UNDERSTAND |(Director of NMP), 'ALL'(New supply/demand cases)|]
[UNDERSTAND |(Director of NMP), 'ALL'(Options for dealing with incidents)|]
[WORKSWITH |(Director of NMP), (Staff), [DETERMINE |(Options for dealing with incidents)|]|]
{EQUALS |(Decision), (Plan for options for dealing with incidents)|}
{IMPLIES |'rumors-about'(Plans for reorganization of DOE), {EQUALS |'perspective-of'(Plan for options for dealing with incidents), "organizational", AND "strategic"|}|}
[UNDERSTAND |(Director of NMP), 'ALL'(Incidents)|]
[ACQUIRE |(Director of NMP), 'ALL'(Incidents)|]
[DECIDES |(Director of NMP), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]|]
[DECIDES |(Director of NMP), {IMPLIES |(Leak from one of the tanks at FMPC), [SHUTDOWN |(Director of NMP), (FMPC)|]|}|]
[INQUIRES |(Director of NMP), (Someone), 'ALL',[SHIPS |(FMPC), (Nuclear material at FMPC)|]|]

[INQUIRES |(Director of NMP), (Someone), 'importance-of',[SHIPS |(FMPC), (Nuclear material at FMPC)|]|]
[INQUIRES |(Director of NMP), (Someone), 'need-for',[SHIPS |(FMPC), (Nuclear material at FMPC)|]|]
[SINCE:NOACT |{EQUALS |'date-of'(Leak from one of the tanks at FMPC), "last week"|}, AND {EQUALS |'status-of'(FMPC), "operating"|}, (Director of NMP), (Leak from one of the tanks at FMPC)|]
{EQUALS |'severity-of'(Leak from one of the tanks at FMPC), "not severe"|}
{CONTRIBUTESTO |(Leak from one of the tanks at FMPC), {EQUALS |'perception-of'(FMPC), "negative"|}|}
{IFTHEN |{CONTINUESTOEQUAL |'status-of'(FMPC), "operating"|}, {CONTINUESTOEQUAL |'existence-of'(Problems at FMPC), "exists"|}|}
{IMPLIES |{EQUALS |'status-of'(SR reactors), "shut down"|}, {IMPLIES |{EQUALS |'production-of'(NMP), "no new plutonium"|}, [DOESNOTNEED |(Director of NMP), (Depleted uranium), (FMPC)|]|}|}
[DETERMINES |(Director of NMP), 'status-of'(FMPC)|]
{IMPACTS |'need-for',{EQUALS |'status-of'(FMPC), "operating"|}, [CONFRONTS |(Director of NMP), (Governor of Ohio), (Governor of Ohios actions)|]|}
[INQUIRES |(Director of NMP), (Someone), 'severity-of'(Governor of Ohios actions)|]
[IFTHEN:TALKWITH |[STOPPED |(Governor of Colorado), 'flow-of-material'(RFP)|], (Director of NMP), (General Council), 'legality-of',[STOPPED |(Governor of Colorado), 'flow-of-material'(RFP)|]|]
{EQUALS |'nature-of',[DECIDES |(DOE), 'nature-of'(Governor of Ohios actions)|], "policy decision"|}
[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]
[INFORMED |(DOE), (Governor of Ohio), 'legality-of'(Governor of Ohios actions)|]
[DECIDED |(DOE), [NOTOVERRIDE |(DOE), (Governor of Ohio), (Governor of Ohios actions)|]|]
[DECIDED |(DOE), {EQUALS |'location-of',[WORKWITH |(DOE), (Governor of Ohio)|], "out of court"|}|]
[NOTGOTO |(DOE), (Court)|]
[SHIP |(DOE), (Nuclear material)|]
[GOTO |(Governor of Ohio), (Court), [STOP |(Governor of Ohio), [SHIP |(DOE), (Nuclear material)|]|]|]
{EQUALS |'priority-of',[DEALSWITH |(Director of NMP), (FMPC)|], "first"|}
[INQUIRES |(Director of NMP), (Someone), 'importance-of',[SHIPS |(FMPC), (Nuclear material at FMPC)|]|]
[DOESNOTWANT |(Director of NMP), [SHUTDOWN |(FMPC)|]|]
{EQUALS |'existence-of'(Leak from one of the tanks at FMPC), "exists"|}
[INQUIRES |(Director of NMP), (Someone), 'ALL'(FMPC)|]
[EVALUATES |(Director of NMP), [SHUTDOWN |(FMPC)|]|]
[INQUIRES |(Director of NMP), (Someone), 'new-information'(FMPC)|]
[INQUIRES |(Director of NMP), (Someone), 'importance-of',[SHIPS |(FMPC), (Nuclear material at FMPC)|]|]
{IMPLIES |{EQUALS |'production-of'(NMP), "no new plutonium"|}, {EQUALS |'importance-of',[SHIPS |(FMPC), (Nuclear material at FMPC)|], "minimal"|}|}
[INQUIRES |(Director of NMP), (Someone), 'time-period-of',{EQUALS |'status-of'(All reactors), "shut down"|}|]
[INQUIRES |(Director of NMP), (Someone), 'ALL',{INCLUDES |(New supply/demand cases), (New stockpile cases)|}|]
[INQUIRES |(Director of NMP), (Someone), 'inventories-of',[SHIPS |(FMPC), (Nuclear material at FMPC)|]|]
[PROVIDES |(FMPC), (Y-12), AND (RFP), (Nuclear material)|]
[INQUIRES |(Director of NMP), (Someone), 'need-for',[SHIPS |(FMPC), (Nuclear material at FMPC)|]|]
[INQUIRES |(Director of NMP), (Someone), 'time-period-of',{EQUALS |'location-of'(Inventories of depleted uranium), (Y-12)|}|]
[WORKSWITH |(Director of NMP), (DAS/MA), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]|]

{IMPLIES |{EQUALS |'attitude-of'(DAS/MA), "unhappy with NMP"|}, {EQUALS |'importance-of',[WORKSWITH |(Director of NMP), (DAS/MA), [STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|]|], "important"|}|}
[WORKSWITH |(Director of NMP), (DAS/MA), [SHUTDOWN |(FMPC)|]|]
[WORKSWITH |(Director of NMP), (DAS/MA), [STOP |(Governor of Ohio), [SHUTDOWN |(FMPC)|]|]|]
{IFTHEN:EQUALS |{EQUALS |'need-for',[SHIPS |(FMPC), (Nuclear material at FMPC)|], "not critical"|}, 'time-period-of',[STOPPED |(Governor of Ohio), (Shipments of nuclear materials through Ohio)|], "six months"|}
[DECIDES |(Director of NMP), {EQUALS |'nature-of',[CONFRONTS |(Director of NMP), (Governor of Ohio), (Governor of Ohios actions)|], "matter of principle"|}|]
[DECIDES |(Director of NMP), [DELAY |[DECIDES |(Director of NMP), [CONFRONTS |(Director of NMP), (Governor of Ohio), (Governor of Ohios actions)|]|]|]|]
{EQUALS |'nature-of',[DECIDES |(Director of NMP), [CONFRONTS |(Director of NMP), (Governor of Ohio), (Governor of Ohios actions)|]|], "difficult"|}
[WAITS |(Director of NMP), [DECIDES |(Director of NMP), [CONFRONTS |(Director of NMP), (Governor of Ohio), (Governor of Ohios actions)|]|]|]
{EQUALS |'nature-of',{EQUALS |'status-of'(All reactors), "shut down"|}, "long-term problem"|}
{EQUALS |'status-of'(All reactors), "shut down"|}
{EQUALS |'nature-of'(Problem), "organizational"|}
[DOESNOTUNDERSTAND |(DAS/MA), 'nature-of',{EQUALS |'status-of'(All reactors), "shut down"|}|]
[DOESNOTBELIEVE |(DAS/MA), {EQUALS |'adequacy-of'(NMP activities), "good enough"|}|]
[WORKSWITH |(Director of NMP), (DAS/MA), [EVALUATE |{EQUALS |'status-of'(All reactors), "shut down"|}|]|]
{IMPACTS |[EVALUATES |(NMP), {EQUALS |'status-of'(All reactors), "shut down"|}|], 'confidence-in',[SHUTDOWN |(NMP), (All reactors)|]|}
[WORKSWITH |(Director of NMP), (DAS/MA), [EVALUATES |(New supply/demand cases)|]|]
[WORKSWITH |(Director of NMP), (DAS/MA), [EVALUATE |{IMPACT |(New supply/demand cases), (National security requirements)|}|]|]
[BELIEVES |(DAS/MA), {EQUALS |'adequacy-of'(NMP activities), "not good enough"|}|]
[BELIEVES |(DAS/MA), {IMPLIES |'change-in'(National security requirements), [RESTARTS |(NMP), (All reactors), {EQUALS |'status-of'(All reactors), "not ready"|}|]|]|]
[ATTACKS |(Director of NMP), 'situation-at'(FMPC)|]
[ATTACKS |(Director of NMP), (Plans for reorganization of DOE), AND 'attitude-of'(DAS/MA)|]

B.3.4 Subject 3, Exercise 4

B.3.4.1 Transcript

Wonder what the decision is here. What are you going to tell your managers to do? I haven't been answering the question of how will this affect Nuclear Materials Production's normal operating strategy. You'll work that out.
Okay. My problem right now is obviously the reactors are down for an environmental review. The question is what does that mean? How long are they going to be down? This isn't quite the same thing as the last one, which was that they're already down. So, and they're going to want to know what's the supply/demand situation? How long can we go without the reactors producing any material before we

will not meet the DOD requirements? And they're also going to ask what are the DOD requirements? Are they real? Because there's a lot of history to the DOD requirements changing downward over time. And the new production reactor issue would come up in that we need to get it on-line quickly. If you're going to have these reactors that could be down forever, they could never come up.
And I assume that we have to go testify soon, like in a few days. So what we would need would be a good, we'd need the best information we had on the demand curves from the DOD. And the best assessment we could get on how long this environmental review would take and what the issues would be. I guess, what the issues would be and therefore how long it would take and what the probable outcome would be. And what the latest schedule was on the new production reactor capacity and how that would fit with the reactors being down.
So let's see. Our decision would be how to present this to the House Armed Services Committee. What's the Departmental line? I mean, what are we going over there, are we just going to go over there and give them information? Just sort of lay out whatever information we have? Or are we going to give them some possible alternatives or ways to deal with it? Are we going to, for instance, accelerate the new production reactor? That could be one way of doing it. I think what we need to do, we need to have a strategy for the hearing. Decide who we want to have there. See if we want to, for instance, encourage the DOD. If they are not calling the DOE, we might suggest that they call the DOD. But first, I'll assume we have enough time to do a little homework. That we haven't been, they shut down the reactors today, we don't have to go up there tomorrow. That they said in two weeks we want you up here to give us an assessment of this situation and find out what does this all mean.
So we would get together with the envrionmental managers since they have seemed to have a different view of it than we do. I mean it looks we didn't want to shut them down. They wanted to shut them down. So obviously we didn't think the situation was so bad. We need to understand how they view it. So we need information from them, as well as information ourselves, from our own system on what it is. We need to have a plan of how to address their concerns and what it would take in-terms-of review to settle the issues. What the issues are. And then a projection of how long it would take to sort it out until the reactor was up. And what the probability was that it was ever going to come up, if it turned out that it was not good. And where we are with the new production reactor. How well we're doing working on that project. Could it be accelerated? What are the options to accelerate it? How much would it cost? How much could we accelerate it? How fast? And then we would put the story together. Decide how we were going to present it.
Probably in two weeks, would not be able to give them a final recommendation. We would not be able to say, "And this is what the Department is going to do." We would give them a time-line how we were going to make the decision. How are we going to go through this? What are going to evaluate? When are we going to know more? When are going to come to them with a proposal? So basically we would be giving them information, but structuring it in a way that it wasn't just sort of going and dumping all the data we know on them. But showing them that we have a process going to reach a decision to make a further recommendation down the road.

B.3.4.2 Translation

The Director of NMP considers the decision.
The Director of NMP considers directing staff.
The Director of NMP considers the impact of incidents on NMP activities.
The reason for the status of all the reactors being shut down is for an environmental review.
The Director of NMP considers the impact of the shut down reactors for an environmental review on NMP activities.
The Director of NMP inquires of someone the time period of the status of the reactors being shut down.
The Director of NMP inquires of someone all about the new supply/demand cases.

The Director of NMP inquires of someone the date of the severity of the impact of the reactors being shut down on DOE's ability to meet the current stockpile case is severe.
The Director of NMP inquires of someone all about the current stockpile case.
The Director of NMP inquires of someone if the quality of the current stockpile case is real.
The trend over time of the current stockpile case is reduced numbers.
The Director of NMP needs the date of the status of NPR being on-line to be quickly.
The time period of the reactors being shut down could equal forever.
The date of the Director of NMP will testify before the HASC is in a few days.
The Director of NMP needs the best information about the current stockpile case.
The Director of NMP needs the best information on the time period of the environmental review.
The Director of NMP needs the best information on the outcome of the envrionmental review.
The reason for the environmental review implies the time period of the environmental review.
The Director of NMP needs the best information on the outcome of the envrionmental review.
The Director of NMP needs the best information on the plan for NPR.
The Director of NMP needs the best information on the new supply/demand cases including NPR and the status of the reactors being shut down.
The Director of NMP decides to inform HASC all about the incidents.
The Director of NMP inquires of someone the party line of DOE.
The Director of NMP inquires of someone if the party line of DOE equals inform HASC all about the incidents or inform HASC of the options for dealing with incidents.
The Director of NMP inquires of someone if DOE is going to accelerate the plan for NPR.
The Director of NMP needs a strategy for testifying before the HASC.
The Director of NMP decides who attends the HASC hearing.
The Director of NMP encourages the DOD to attend the HASC hearing.
If the HASC is not asking the DOE to attend the HASC hearing, the Director of NMP suggests to HASC to ask the DOD to attend the HASC hearing.
The difference between today and the date of testifying is sufficent to investigate the incidents.
The date of the reactors being shut down is today.
The date of testifying is not tomorrow.
The date of testifying is in two weeks.
The reason for testifying is the Director of NMP provides HASC an evaluation of the the incidents and an evaluation of the impact of the incidents.
Since the perspective of DOE environmental managers is not equal the perspective of the Director of NMP, the Director of NMP works with the DOE environmental managers on the environmental review.
The Director of NMP did not want to shut down all the reactors.
The DOE envrionmental managers wanted to shut down all the reactors.
The perspective of the Director of NMP of the problems with all the reactors was not so bad.
The Director of NMP needs to understand the perspective of DOE environmental managers.
The Director of NMP needs DOE environmental managers to inform the Director of NMP all about the environmental review.
The Director of NMP needs for NMP to inform the Director of NMP all about the environmental review.
The Director of NMP needs a plan for addressing the concerns of DOE environmental managers and a plan for resolving the issues with the environmental review.
The Director of NMP inquires of someone what the issues are with the environmental review.
The Director of NMP projects the time period of the environmental review which equals the time period of the reactors being shut down.
The Director of NMP inquires of someone the probability of the time period of the reactors being shut down being forever.
The Director of NMP inquires of someone the plan for NPR.
The Director of NMP inquires of someone if DOE can accelerate the plan for NPR.
The Director of NMP inquires of someone the options for accelerating the plan for NPR.

The Director of NMP inquires of someone the cost of accelerating the plan for NPR.
The Director of NMP inquires of someone the magnitude of accelerating the plan for NPR.
The Director of NMP inquires the date of accelerating the plan for NPR.
The Director of NMP integrates all the information about the incidents.
The Director of NMP decides on the strategy for testifying to HASC.
The date of the HASC hearing equalling two weeks implies the Director of NMP does not provide HASC a final recommendation.
The Director of NMP provides HASC a plan for deciding about the incidents.
The Director of NMP informs HASC a plan for evaluating the incidents.
The Director of NMP informs HASC the date of someone informs the Director of NMP all about the incidents.
The Director of NMP informs HASC the date of the Director of NMP provides HASC with a final recommendation.
The Director of NMP informs HASC with the form of the information about the incidents being structured.
The Director of NMP informs HASC the outcome of the plan for deciding about the incidents is a final recommendation.
The Director of NMP informs HASC that the date of the Director of NMP provides HASC with a final recommendation is down the road.

B.3.4.3 Coded Protocol

[CONSIDERS I(Director of NMP), [DECIDES I(Something)I]I]
[CONSIDERS I(Director of NMP), [DIRECTS I(Director of NMP), (Staff), (Something)I]I]
[CONSIDERS I(Director of NMP), {IMPACTS I(Incidents), (NMP activities)I}I]
{EQUALS I'reason-for',{EQUALS I'status-of'(All reactors), "shut down"I}, (Environmental review)I}
[CONSIDERS I(Director of NMP), {IMPACT I{EQUALS I'reason-for',{EQUALS I'status-of'(All reactors), "shut down"I}, (Environmental review)I}, (NMP activities)I}I]
[INQUIRES I(Director of NMP), (Someone), 'time-period-of',{EQUALS I'status-of'(All reactors), "shut down"I}I]
[INQUIRES I(Director of NMP), (Someone), 'ALL'(New supply/demand cases)I]
[INQUIRES I(Director of NMP), (Someone), 'date-of',{EQUALS I'severity-of',{IMPACTS I{EQUALS I'status-of'(All reactors), "shut down"I}, (DOEs ability to meet the current stockpile case)I}, "severe"I}I]
[INQUIRES I(Director of NMP), (Someone), 'ALL'(Current stockpile case)I]
[INQUIRES I(Director of NMP), (Someone), {EQUALS I'quality-of'(Current stockpile case), "real"I}I]
{EQUALS I'trend-over-time-of'(Current stockpile case), "reduced numbers"I}
[NEEDS I(Director of NMP), {EQUALS I'date-of',{EQUALS I'status-of'(New production reactor capability), "operating"I}, "quickly"I}I]
{EQUALS I'time-period-of',{EQUALS I'status-of'(All reactors), "shut down"I}, "forever"I}
{EQUALS I'date-of',[WILLTESTIFY I(Director of NMP), (HASC), (NMPs ability to meet national security requirements)I], "few days"I}
[NEEDS I(Director of NMP), 'best'(Current stockpile case)I]
[NEEDS I(Director of NMP), 'best',{WHATIS I'time-period-of'(Environmental review)I}I]
[NEEDS I(Director of NMP), 'best',{WHATIS I'outcome-of'(Environmental review)I}I]
{IMPLIES I'reason-for'(Environmental review), 'time-period-of'(Environmental review)I}
[NEEDS I(Director of NMP), 'best',{WHATIS I'outcome-of'(Environmental review)I}I]
[NEEDS I(Director of NMP), 'best',{WHATIS I'plan-for'(New production reactor capability)I}I]
[NEEDS I(Director of NMP), 'best',{INCLUDES I(New supply/demand cases), (New production reactor capability), AND {EQUALS I'status-of'(All reactors), "shut down"I}I}I]

[DECIDES |(Director of NMP), [INFORMS |(Director of NMP), (HASC), 'ALL'(Incidents)|]|]
[INQUIRES |(Director of NMP), (Someone), 'party-line-of'(DOE)|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'party-line-of'(DOE), [INFORMS |(Director of NMP), (HASC), 'ALL'(Incidents)|], OR [INFORMS |(Director of NMP), (HASC), (Options for dealing with incidents)|]|}|]
[INQUIRES |(Director of NMP), (Someone), [ACCELERATE |(DOE), 'plan-for'(New production reactor capability)|]|]
[NEEDS |(Director of NMP), 'strategy-for',[WILLTESTIFY |(Director of NMP), (HASC), (NMPs ability to meet national security requirements)|]|]
[DECIDES |(Director of NMP), 'who',[ATTENDS |(HASC hearings)|]|]
[ENCOURAGES |(Director of NMP), (DOD), [ATTENDS |(DOD), (HASC hearings)|]|]
[IFTHEN:SUGGESTS |[NOTASKING |(HASC), (DOD), [ATTENDS |(DOD), (HASC hearings)|]|], (Director of NMP), (HASC), [ASKS |(HASC), (DOD), [ATTENDS |(DOD), (HASC hearings)|]|]|]
{EQUALS |{DIFFERENCE |"Today", 'date-of'(HASC hearings)|}, "sufficient to investigate the incidents"|}
{EQUALS |'date-of',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "today"|}
{NOTEQUALS |'date-of',[WILLTESTIFY |(Director of NMP), (HASC), (NMPs ability to meet national security requirements)|], "tomorrow"|}
{EQUALS |'date-of',[WILLTESTIFY |(Director of NMP), (HASC), (NMPs ability to meet national security requirements)|], "two weeks"|}
{EQUALS |'reason-for',(HASC hearings), [PROVIDES |(Director of NMP), (HASC), [EVALUATES |(Incidents)|]|], AND [PROVIDES |(Director of NMP), (HASC), [EVALUATES |{IMPACTS |(Incidents), (NMP activities)|}|]|]|}
[BECAUSE:WORKSWITH |{NOTEQUAL |'perspective-of'(DOE Environmental Managers), 'perspective-of'(Director of NMP)|}, (Director of NMP), (DOE Environmental Managers), (Environmental review)|]
[DIDNOTWANT |(Director of NMP), [SHUTDOWN |(Secretary of Energy), (All reactors)|]|]
[WANTED |(DOE Environmental Managers), [SHUTDOWN |(Secretary of Energy), (All reactors)|]|]
{EQUALS |'perspective-of'(Director of NMP), 'problems-of'(All reactors), "not so bad"|}
[NEEDS |(Director of NMP), [UNDERSTAND |'perspective-of'(DOE Environmental managers)|]|]
[NEEDS |(Director of NMP), [INFORMS |(DOE Environmental Managers), (Director of NMP), 'ALL'(Environmental review)|]|]
[NEEDS |(Director of NMP), [INFORMS |(Staff), (Director of NMP), 'ALL'(Environmental review)|]|]
[NEEDS |(Director of NMP), 'plan-for',[ADDRESSES |(Director of NMP), 'concerns-of'(DOE Environmental Managers)|], AND 'plan-for',[RESOLVES |(Director of NMP), 'reason-for'(Environmental review)|]|]
[INQUIRES |(Director of NMP), (Someone), 'reason-for'(Environmental review)|]
[PROJECTS |(Director of NMP), {EQUALS |'time-period-of'(Environmental review), 'time-period-of',{EQUALS |'status-of'(All reactors), "shut down"|}|}|]
[INQUIRES |(Director of NMP), (Someone), 'probability-of',{EQUALS |'time-period-of',{EQUALS |'status-of'(All reactors), "shut down"|}, "forever"|}|]
[INQUIRES |(Director of NMP), (Someone), 'plan-for'(New production reactor capability)|]
[INQUIRES |(Director of NMP), (Someone), [ACCELERATE |(DOE), 'plan-for'(New production reactor capability)|]|]
[INQUIRES |(Director of NMP), (Someone), 'options-for',[ACCELERATE |(DOE), 'plan-for'(New production reactor capability)|]|]
[INQUIRES |(Director of NMP), (Someone), 'cost-of',[ACCELERATE |(DOE), 'plan-for'(New production reactor capability)|]|]
[INQUIRES |(Director of NMP), (Someone), 'magnitude-of',[ACCELERATE |(DOE), 'plan-for'(New production reactor capability)|]|]
[INQUIRES |(Director of NMP), (Someone), 'date-of',[ACCELERATE |(DOE), 'plan-for'(New production reactor capability)|]|]

[INTEGRATES |(Director of NMP), 'ALL'(Incidents)|]
[DECIDES |(Director of NMP), 'strategy-for',[WILLTESTIFY |(Director of NMP), (HASC), (NMPs ability to meet national security requirements)|]|]
{IMPLIES |{EQUALS |'date-of'(HASC hearings), "two weeks"|}, [DOESNOTPROVIDE |(Director of NMP), (HASC), (Final recommendation)|]|}
[PROVIDES |(Director of NMP), (HASC), 'plan-for',[DECIDES |(Director of NMP), [DEALSWITH |(Incidents)|]|]|]
[PROVIDES |(Director of NMP), (HASC), 'plan-for',[EVALUATES |(Director of NMP), (Incidents)|]|]
[INFORMS |(Director of NMP), (HASC), 'date-of',[INFORMS |(Someone), (Director of NMP), 'ALL'(Incidents)|]|]
[INFORMS |(Director of NMP), (HASC), 'date-of',[PROVIDES |(Director of NMP), (HASC), (Final recommendation)|]|]
[INFORMS |(Director of NMP), (HASC), {EQUALS |'nature-of',{WHATIS |'ALL'(Incidents)|}, "structured"|}|]
[INFORMS |(Director of NMP), (HASC), {EQUALS |'outcome-of',{WHATIS |'plan-for',[DECIDES |(Director of NMP), [DEALSWITH |(Incidents)|]|]|}, (Final recommendation)|}|]
[INFORMS |(Director of NMP), (HASC), {EQUALS |'date-of',[PROVIDES |(Director of NMP), (HASC), (Final recommendation)|], "down the road"|}|]

B.3.5 Subject 3, Exercise 5

B.3.5.1 Transcript

Okay. What we need here is to reassess our whole strategy. I mean there is no immediate decision here. We don't have to go to a hearing next week. But considering that all the reactors got shut down this week for environmental review, well, let me leave aside this point of whether there's any immediate thing that has to be dealt with, like the reporters are calling about what you're going to do with this. In fact, even the reporters are calling, I would say the first thing to do when you have this kind of situation, and it's probably true in the others, is that you really need to step back and figure out what we're going to do in the long term for this.
We have much more serious arms control discussions going on here. And there is going to be a need to come up with various scenarios on the stockpile up and down, well down, for this. We've got the reactors down. Again we'll need to assess just what that means. They just got shut down this week for an environmental review and we probably don't know at this point how serious it is. But it looks like there's going to be, someone else, it looks like there's going to be someone else in charge of restarting them--not us. We may be in charge of planning, but we're not going to be in charge of the reactor start-up program. And WIPP, which is supposed to deal with plutonium wastes is in trouble and we may have to go to some kind of backup. It says it is not coming on-line anywhere near the estimated time and rumor is it may never come on-line. So, what we need to do here is to look at what the demand cases are likely to be in the future and decide how we want to deal with SIS, because we've had, indicate a major break-through, if it's possible in SIS. On the other hand, you may not need SIS. This is kind of ironic. You get a major break-through in SIS you may not have any need for it. But given that, and knowing the pressures that come to bear when you have something like this happen, I think we would need to step back and figure out what our plutonium production strategy was going to be and what our

tritium production strategy was going to be for the Savannah River reactors which are the only ones we have available to make tritium because we've assumed N-reactor is permanently shut down. We don't have any other options here.
So, I would ask all those questions again about supply, about demand, about, I'd try to find out what the situation was with these agreements. How likely are they to happen? How extreme are the cases? Have we got some really extreme cases here? Do they involve build down? Do they involve making commitments to tear down the weapons, because that's going to be a problem if we don't have WIPP operating sometime in the future, we're not going to have any place to put the plutonium wastes. We're going to have to have a strategy for dealing with plutonium wastes. Alternate strategy to WIPP, if this is looking serious. And how does the SIS break-through fit with this? Because we're bound to get questions on that, well what are you going to do with this? I think it's just interesting. An SIS break-through would be about the last thing that would be of interest in this scenario, because getting more plutonium into the system, SIS doesn't deal with the waste. SIS creates some plutonium waste. Less than probably than some of the reprocessing, scrap recovery, but still, it would be a tough decision deciding that you were going to put your resources into SIS at this point when you have all these problems and you may not have any place for the waste to go. You may have to do something about reprocessing the waste or extracting the plutonium from the waste or whatever.
So, we would go through again the why were the reactors shut down and understand what that problem is. Make a projection.
It'd be kind of interesting since we weren't going to be in charge of restarting them, how to make that projection. But we would need, if we're still in charge of the planning, we would need to do that somehow. And then talk to the waste management about what we're going to do, what are the alternatives if we don't have WIPP and we don't have a place to store the waste and what kind of storage options do we have it we don't have WIPP? And could this SIS break-through, I don't know what it is, could this SIS break-through contribute to this? Or would it just be pressure to put money into that technology for some future need that might not come in.

B.3.5.2 Translation

The Director of NMP evaluates the strategy for NMP activities.
The date of the decision is not immediate.
The date of the Director of NMP going to congressional hearings is not next week.
The Director of NMP considers the status of all the reactors being shut down this week.
The Director of NMP considers the date of dealing with something being immediate.
Something immediate includes reporters inquiring of the Director of NMP the plans for dealing with the incidents.
Reporters inquiring of the Director of NMP the plans for dealing with incidents does not impact NMP activities.
The first priority of Director of NMP is to consider the long-term time period of NMP activities.
The nature of the arms limitation talks is much more serious.
The Director of NMP determines new stockpile cases including the number of nuclear weapons being reduced.
The status of all the reactors is shut down.
The Director of NMP evaluates the impact of all the reactors being shut down on NMP activities.
The Secretary of Energy shut down all the reactors this week.
The reason for shutting down all the reactors was to conduct an environmental review.
The Director of NMP does not know the severity of the Secretary of Energy shutting down all the reactors.
The Secretary of Energy will create a special task force for restarting all the reactors.
The responsibilities of Director of NMP does not include restarting all the reactors.

The responsibilities of the Director of NMP includes planning.
The responsibilities of Director of NMP does not include restarting all the reactors.
WIPP deals with plutonium wastes.
The status of WIPP is in trouble.
The DOE may need to employ an alternative to WIPP.
The status of WIPP startup is nowhere near the estimated time.
The rumors about WIPP are WIPP may never come on-line.
The Director of NMP needs to evaluate the new stockpile cases.
The report on major, break-through's in SIS, the Director of NMP needs to decide dealing with SIS.
The Director of NMP doubts the report on major, break-throughs in SIS.
The Director of NMP may not need SIS.
It is ironic that the report on major, break-through's in SIS exists and the Director of NMP may not need SIS.
The pressures of the report on major, break-through's in SIS imply the Director of NMP determines the strategy for plutonium production of SR reactors and the strategy for tritium production of SR reactors.
The status of N-reactor being considered permanently shut down implies the SR reactors are the only reactors available to produce tritium.
Alternative supplies of plutonium do not exist.
The Director of NMP inquires of someone all about the supply of nuclear material.
The Director of NMP inquires of someone all about the demand for nuclear material.
The Director of NMP inquires of someone all about the U.S.-Soviet agreement.
The Director of NMP inquires of someone the probablity of the existence of U.S.-Soviet agreement.
The Director of NMP inquires the nature of the new stockpile cases.
The Director of NMP inquires if the nature of the new stockpile cases is extreme.
The Director of NMP inquires if the new stockpile cases include reduction in the number of nuclear weapons.
If the date of WIPP operating is not sometime in the future, then because there's no place to put plutonium waste, disassembling weapons is a problem.
The Director of NMP needs a strategy for dealing with plutonium wastes.
If the rumors about WIPP never come on-line are serious, the Director of NMP needs a strategy for alternatives to WIPP.
The Director of NMP inquires of someone what the relationship is between the report on major, break-through's in SIS and the status of WIPP.
Someone inquires of the Director of NMP how the Director of NMP is dealing with the report on major, break-through's in SIS.
The attitude of the Director of NMP about the major, break-through's in SIS is interested.
The need for more new plutonium production implies the value of the report on major, break-through's in SIS is the last thing that would be of interest.
SIS does not deal with plutonium waste.
SIS creates plutonium waste.
The amount of plutonium waste SIS creates is probably less than the amount of plutonium waste scrap recovery creates.
The problems that exist and the status of WIPP imply the difficulty of the decision to provide more resources to SIS would be difficult.
The Director of NMP may have to recover plutonium wastes.
The Director of NMP inquires of someone the reason for the status of the reactors being shut down.
The Director of NMP must understand the reason for the status of the reactors being shut down.
The Director of NMP projects the time period of the status of the reactors being shut down.
The fact that the responsibilities of the Director of NMP do not include restarting all the reactors implies the nature of projecting the time period of the status of the reactors being shut down is interesting.
If the responsibilities of the Director of NMP includes planning, then the Director of NMP needs to project the time period of the status of the reactors being shut down.

The Director of NMP informs EM about the plan for NMP activities.
The Director of NMP inquires of EM the alternatives to WIPP.
The Director of NMP informs EM that a place to store plutonium waste doesn't exist.
The Director of WIPP inquires of EM the alternatives to WIPP.
The Director of NMP inquires about the value of the report on major, break-through's in SIS.
The Director of NMP inquires of someone if the report on major, break-through's in SIS implies pressure to put money into SIS which the date of start up equals may never come in.

B.3.5.3 Coded Protocol

[EVALUATES |(Director of NMP), 'strategy-for'(NMP activities)|]
{EQUALS |'date-of',[DECIDES |(Director of NMP), (Something)|]|}
{NOTEQUALS |'date-of'(Congressional hearings), "next week"|}
[CONSIDERS |(Director of NMP), {EQUALS |'date-of',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "this week"|}|]
[CONSIDERS |(Director of NMP), {EQUALS |'date-of',[DEALSWITH |(Director of NMP), (Something)|], "immediate"|}|]
{INCLUDES |{EQUALS |'date-of',[DEALSWITH |(Director of NMP), (Something)|], "immediate"|}, [INQUIRES |(Reporters), (Director of NMP), 'plan-for', [DEALSWITH |(Director of NMP), (Incidents)|]|]|}
{NOIMPACT |[INQUIRES |(Reporters), (Director of NMP), 'plan-for', [DEALSWITH |(Director of NMP), (Incidents)|]|], (NMP activities)|}
{EQUALS |'priority-of', [CONSIDERS |(Director of NMP), {EQUALS |'time-period-of'(NMP activities), "long term"|}|], "first"|}
{EQUALS |'nature-of'(Arms limitation talks), "much more serious"|}
[DETERMINES |(Director of NMP), {INCLUDES |(New stockpile cases), {EQUALS |'number-of'(Nuclear weapons), "reduction"|}|}|]
{EQUALS |'status-of'(All reactors), "shut down"|}
[EVALUATES |(Director of NMP), {IMPACT |{EQUALS |'status-of'(All reactors), "shut down"|}, (NMP activities)|}|]
{EQUALS |'date-of',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "this week"|}
{EQUALS |'reason-for',[SHUTDOWN |(Secretary of Energy), (All reactors)|], "environmental review"|}
[DOESNOTKNOW |(Director of NMP), 'severity-of',[SHUTDOWN |(Secretary of Energy), (All reactors)|]|]
[CREATE |(Secretary of Energy), (Special task force for restarting all the reactors)|]
{DOESNOTINCLUDE |'responsibilities-of'(Director of NMP), [RESTART |(All reactors)|]|}
{INCLUDES |'responsibilities-of'(Director of NMP), [PLANNING |(Something)|]|}
{DOESNOTINCLUDE |'responsibilities-of'(Director of NMP), [RESTART |(All reactors)|]|}
[DEALSWITH |(WIPP), (Plutonium waste)|]
{EQUALS |'status-of'(WIPP), "in trouble"|}
{EQUALS |'probability-of',[NEED |(DOE), [EMPLOY |(Alternatives to WIPP)|]|], "maybe"|}
{EQUALS |'status-of'(WIPP), "nowhere near the estimated time"|}
{EQUALS |'rumors-about'(WIPP), "may never come on-line"|}
[NEEDS |(Director of NMP), [EVALUATE |(DIrector of NMP), (New stockpile cases)|]|]
{IMPLIES |(Report on major, SIS break-throughs), [NEEDS |(Director of NMP), [DECIDES |[DEALSWITH |(SIS)|]|]|]|}
[DOUBTS |(Director of NMP), 'truth-of'(Report on major, SIS break-throughs)|]
[MAYNOTNEED |(Director of NMP), (SIS)|]
{EQUALS |'nature-of',{WITH |{EQUALS |'existence-of'(Report on major, SIS break-throughs), "exists"|}, [MAYNOTNEED |(Director of NMP), (SIS)|]|}, "ironic"|}

{IMPLIES I'pressures-of'(Report on major, SIS break-throughs), [DETERMINES I(Director of NMP), 'strategy-for-plutonium-production'(SR reactors), AND 'strategy-for-tritium-production'(SR reactors)I]I}
{IMPLIES I{EQUALS I'status-of'(N-reactor), "considered permanently shutdown"I}, {EQUALS I'value-of'(SR reactors), "only reactors available to produce tritium"I}I}
{EQUALS I'existence-of'(Alternative supplies of plutonium), "dont exist"I}
[INQUIRES I(Director of NMP), (Someone), 'ALL'(Supply of nuclear material)I]
[INQUIRES I(Director of NMP), (Someone), 'ALL'(Demand for nuclear material)I]
[INQUIRES I(Director of NMP), (Someone), 'ALL'(U.S.-Soviet agreements)I]
[INQUIRES I(Director of NMP), (Someone), 'probability-of',{EQUALS I'existence-of'(U.S.-Soviet agreements), "exists"I}I]
[INQUIRES I(Director of NMP), (Someone), 'nature-of'(New stockpile cases)I]
[INQUIRES I(Director of NMP), (Someone), {EQUALS I'nature-of'(New stockpile cases), "extreme"I}I]
[INQUIRES I(Director of NMP), (Someone), {INCLUDES I(New stockpile cases), {EQUALS I'number-of'(Nuclear weapons), "reduced"I}I}I]
{IFTHEN:IMPLIES I{NOTEQUALS I'date-of',[STARTUP I(WIPP)I], "sometime in the future"I}, {EQUALS I'existence-of'(Alternative storage locations to WIPP), "dont exist"I}, {EQUALS I'nature-of',[DISASSEMBLE I(Nuclear weapons)I], "problem"I}I}
[NEEDS I(Director of NMP), 'strategy-for',[DEALSWITH I(Plutonium waste)I]I]
[IFTHEN:NEEDS I{EQUALS I'nature-of',{EQUALS I'rumors-about'(WIPP), "may never come on-line"I}, "serious"I}, (Director of NMP), 'strategy-for'(Alternatives to WIPP)I]
[INQUIRES I(Director of NMP), (Someone), {WHATIS I(Report on major, SIS break-throughs), 'status-of'(WIPP)I}I]
[INQUIRES I(Someone), (Director of NMP), 'plan-for',[DEALSWITH I(Director of NMP), (Report on major, SIS break-throughs)I]I]
{EQUALS I'attitude-of'(Director of NMP), (Report on major, SIS break-throughs), "interested"I}
{IMPLIES I[NEEDS I(Director of NMP), (Reactor production of plutonium)I], {EQUALS I'value-of'(Report on major, SIS break-throughs), "last thing that would be of interest"I}I}
[DOESNOTDEALWITH I(SIS), (Plutonium waste)I]
[CREATES I(SIS), (Plutonium waste)I]
{LESSTHAN I'amount-of',[CREATES I(SIS), (Plutonium waste)I], 'amount-of',[CREATES I(Scrap recovery), (Plutonium waste)I]I}
{IMPLIES I{EQUALS I'existence-of'(Problem), "exist"I}, AND 'status-of'(WIPP), {EQUALS I'difficulty-of',[DECIDES I(Director of NMP), [PROVIDE I(SIS), (Resources)I]I], "difficult"I}I}
[MAYRECOVER I(Director of NMP), (Plutonium waste)I]
[INQUIRES I(Director of NMP), (Someone), 'reason-for',[SHUTDOWN I(Secretary of Energy), (All reactors)I]I]
[UNDERSTANDS I(Director of NMP), 'reason-for',[SHUTDOWN I(Secretary of Energy), (All reactors)I]I]
[PROJECTS I(Director of NMP), 'time-period-of',{EQUALS I'status-of'(All reactors), "shut down"I}I]
{IMPLIES I{DOESNOTINCLUDE I'responsibilities-of'(Director of NMP), [RESTART I(All reactors)I]I}, {EQUALS I'nature-of',[PROJECTS I(Director of NMP), 'time-period-of',{EQUALS I'status-of'(All reactors), "shut down"I}I], "interesting"I}I}
[IFTHEN:NEEDS I{INCLUDES I'responsibilities-of'(Director of NMP), [PLANNING I(Something)I]I}, (Director of NMP), [PROJECTS I(Director of NMP), 'time-period-of',{EQUALS I'status-of'(All reactors), "shut down"I}I]I]
[INFORMS I(Director of NMP), (EM), 'plan-for'(NMP activities)I]
[INQUIRES I(Director of NMP), (EM), (Alternatives to WIPP)I]
[INFORMS I(Director of NMP), (EM), {EQUALS I'existence-of'(Alternative storage locations to WIPP), "dont exist"I}I]
[INQUIRES I(Director of NMP), (EM), (Alternatives to WIPP)I]
[INQUIRES I(Director of NMP), (Someone), 'value-of'(Report on major, SIS break-throughs)I]

[INQUIRES l(Director of NMP), (Someone), {IMPLIES l(Report on major, SIS break-throughs), [PRESSURES l(Someone), (Director of NMP), [FUND l{EQUALS l'date-of'(SIS), "may never come in"l}l]]l]l}l]

B.4 Subject 4

B.4.1 Subject 4, Exercise 1

B.4.1.1 Transcript

The areas where I see the Director of NMP should have some input, or some decision making, or strategizing, would deal with the potential budget cut and potentially responding, I guess, to the contamination incident and also the reactor shutdown.
On the reactor shutdown, I would go through a process similar to what I did in the practice exercise and that is to understand the reason the reactor was shut down. Is it a normal shutdown? Or is it a shutdown because of some unusual occurrence or problem? If it's a normal shutdown, what we would do, we would be expecting it. If it was a normal shutdown, we would already have data at our hands, the forecast for example, that would say we expect to shut this reactor down at this time. And we would also have a schedule for the outage. And I would expect my program managers then to follow the outage activities to make sure that the outage is going well and was properly planned and is being properly executed so that we don't have an extremely long outage and impact production. If it was a shutdown because of a problem, I would ask the program managers to understand what the cause of the problem was for that reactor, to look at the potential implications for the other reactors, to examine the corrective actions that the operations office was taking to correct the problem and get the reactor restarted. And also is the operations office looking at the other two reactors to preclude that kind of a problem from occurring there? I would get an assessment when sufficient information was available, an assessment of what the plans are for correcting the problem and for restart of the reactor. And I could go on for a long time. But if it's a major problem, if it's a problem that would say the reactor was going to be shutdown for an indeterminate period, or a long period where it's going to impact the production of plutonium and/or tritium depending on what kind of charge is in the reactor, I would look into what compensatory measures could be taken. For example, on tritium, we might want to try to accelerate getting tritium returns from weapons to fill in the period where we would be normally getting material extracted.
I would be generally looking to see if there was any way we could expedite the completion of the corrective actions and the restart of the reactor and to make sure the appropriate actions are taken on the other reactors to preclude their shutdown, or to, if necessary, correct the problem. If it's a significant safety problem that's generic to all the reactors, we would have to consider, strongly consider, shutting down the other reactors until it's fixed. And if such a dramatic decision had to be made, we would then have to also work with Military Applications on the implications of that to the supply of materials for their activities.

On the potential budget cut of 25% to rid the DOE of waste, fraud, and abuse, I would propose mounting a briefing to the staff of key members that might be involved in such a cut, to educate them as to how and where the money in the NMP budget is spent, what it's used for, what controls we have in place to prevent waste, fraud, and abuse. And what the impacts of the cut would be if it was indeed implemented. We would work through DP-50 and Congressional Affairs to try to set-up some kind of educational process for key staffers of these congressmen to try to at least get our point-of-view across to these people. The other thing we would do would be to make sure the congressmen in the regions that would be affected by such cuts, are also informed that this activity is going on including potential impacts to their constituency.

As far as the incident of contamination, it says yet another incident of contamination. That's interesting because we have had a problem of contamination incidents, especially at Savannah River, for the last nine months. And of course with the existing climate of high visibility, they are getting a lot of visibility. But this goes to the heart of improving the conduct of operations at our facilities. The exercise says 1988 and 1989. 1989 is when we really got into programs to make a major improvement in the conduct of operations of our facilities. And now, each incident is considered very important. It's reported, whereas before, such incidents were not reported into headquarters necessarily. And even though this incident is not at one of our facilities, it would be reviewed as far as it's applicability to our facilities and any lessons learned that we could get from that incident. There's no way you're going to influence the press on their reporting of the incident, and it's not our facility, but I think we would try to learn from that incident as to what and how we might be improving the performance of our contractors as far as contamination control is concerned.

In the area of arms limitation talks, I would ask my planning staff to interface with the DOE arms control people to stay abreast of the direction the talks are taking and to initiate studies when we have firm enough information to determine the range of potential impacts on our facilities and our supply/ demand situation so that we can assess the range of potential impacts on our operations. And if indeed, the 25% budget cut, for example, were to come to pass and we had to start making very hard decisions on facility shutdowns and that kind of thing, we could make those decisions in the light of what is likely to occur as far as arms limitations. We would hate to be put in that position of having to make decisions before those talks are completed, but if we were put in that position, we would need to have that information available.

B.4.1.2 Translation

The Director of NMP considers the contamination at Rocky Flats Plant and the reactor was shut down.
The Director of NMP needs to understand the reason for the reactor was shut down.
The Director of NMP inquires of someone if the nature of the reactor was shut down is a normal shutdown.
The Director of NMP inquires of someone if the nature of the reactor was shut down was an unusual occurrence or a problem.
If the nature of the reactor was shut down is normal, then the Director of NMP would know all about the reactor being shut down.
If the nature of the reactor was shut down is normal, then the Director of NMP would know the time period of the reactor being shut down.
The Director of NMP expects the NMP program managers to monitor the outage activities.
The reason for the NMP program managers to monitor the outage is to ensure the status of the outage is according to plan.
The reason for the NMP program managers to monitor the outage is to ensure the plan for the reactor was shut down is proper.
The reason for the NMP program managers to monitor the outage is to ensure the time period of the reactor was shut down is not an extremely long outage which would impact production of nuclear material.

The Director of NMP directs the NMP program managers to understand the cause of the reason for the reactor was shut down.
The Director of NMP directs the NMP program managers to determine the impact of the reactor was shut down on the other reactors.
The Director of NMP directs the NMP program managers to examine the corrective actions of SR to restart the reactor.
The Director of NMP inquires of the NMP program managers if SR is considering the other reactors to avoid the same problem.
When all about the reactor was shut down is available, the Director of NMP assesses the plans for restarting the reactor that was shut down.
The time period of the reactor being shut down is indeterminate or a long time, the which would impact the supply of plutonium and tritium,
If the reason for the reactor being shut down implies the time period of the reactor being shut down is indeterminate or a long time, the Director of NMP looks for alternative supplies of nuclear material.
The impact of the reactor being shut down on the supply of what nuclear material depends on the current charge in the reactor.
The Director of NMP considers the alternatives for tritium supply includes accelerating the weapons returns.
The Director of NMP considers ways of accelerating the completion of corrective actions and the restart of the reactor that was shut down.
The Director ensures the nature of actions on the other reactors is appropriate.
If the nature of the reason for the reactor being shut down is a significant safety problem that is generic to all reactors, the Director considers shutting down all the reactors.
The time period of all the reactors being down is until corrective actions are complete.
If the Director of NMP decides to shut down all reactors, then the Director of NMP works with OMA to detemine the implications of shutting down all reactors on the supply of nuclear materials.
The Director of NMP considers the proposal to cut DOE's budget by 25% to rid the DOE of waste, fraud, and abuse.
The Director of NMP briefs the staff of key congressmen proposing to cut DOE's budget by 25%.
The purpose of the Director briefing congressional staff is to inform them where the NMP budget is spent.
The purpose of the Director briefing congressional staff is to inform staff of the NMP budget controls to prevent waste, fraud, and abuse.
The purpose of the Director briefing congressional staff is to inform staff of the impact of the proposed budget cuts on NMP activities.
The Director of NMP works with DP-50 and Congressional Affairs to establish educational process for the congressional staff of key congressmen.
The purpose of establishing an educational process is to present the perspective of the Director of NMP about the proposed budget cuts.
The Director of NMP informs congressmen in the regions affected by the proposed budget cuts about the proposed budget cuts and the impact of proposed budget cuts on their regions.
The Director of NMP considers the incident of contamination at Rocky Flats Plant.
The time period of contamination incidents at NMP facilities is the last nine months.
The location of many of the contamination incidents at NMP facilities was SR.
Because of the visibility of DOE being very high, the visibility of RFP will equal very high.
The incident of contamination at RFP implies improving the conduct of operations at NMP facilities.
The time period of establishing programs to improve the conduct of operations at NMP facilities began in 1989.
All incidents of contamination are very important.
The time period of someone not informing NMP of incidents of contamination equals before 1989.
Even though NMP does not own RFP, the Director of NMP evaluates the implications of the contamination at RFP to NMP facilities.
The Director of NMP cannot influence the media on the reporting of the incident of contamination at RFP.

NMP does not own RFP.
The Director of NMP learns from the incident of contamination at RFP.
What the Director of NMP learns from the incident of contamination at RFP impacts improving the performance of NMP contractors on contamination.
The Director of NMP considers the arms limitation talks.
The Director of NMP directs the NMP planning group to work with DOE arms control people to monitor the arms limitation talks.
The Director of NMP directs the NMP planning group to evaluate the impact of arms limitation talks on NMP facilities.
The Director of NMP directs the NMP planning group to evaluate the impact of arms limitation talks on the current supply/demand case.
The Director of NMP evaluates the impact of arms limitation talks on NMP activities.
If the status of the proposed budget cut is comes to pass, and the Director of NMP decides to shut down NMP facilities, the decision to shut down NMP facilities in light of the outcomes of the arms limitation talks.
The Director of NMP does not want to make decisions to shut down NMP facilities without the arms limitation talks complete.
If the Director of NMP must make decisions about the status of NMP facilities the Director of NMP needs all about the arms limitation talks.

B.4.1.3 Coded Protocol

[CONSIDERS |(Director of NMP), (Contamination at RFP)|]
[UNDERSTAND |(Director of NMP), 'reason-for'(Reactor was shut down)|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'reason-for'(Reactor was shut down), "normal"|}|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'reason-for'(Reactor was shut down), "unusual occurrence", OR "problem"|}|]
[IFTHEN:KNOWS |{EQUALS |'reason-for'(Reactor was shut down), "normal"|}, (Director of NMP), 'all'(Reactor was shut down)|]
[IFTHEN:KNOWS |{EQUALS |'reason-for'(Reactor was shut down), "normal"|}, (Director of NMP), 'time-period-of'(Reactor was shut down)|]
[DIRECTS |(Director of NMP), (NMP Division Director), [MONITOR |(NMP Division Director), 'all'(Reactor outage)|]|]
{EQUALS |'reason-for',[MONITOR |(NMP Division Director), 'all'(Reactor outage)|], [ENSURE |(Director of NMP), {EQUALS |'status-of'(Reactor outage), "according to plan"|}|]|}
{EQUALS |'reason-for',[MONITOR |(NMP Division Director), 'all'(Reactor outage)|], [ENSURE |(Director of NMP), {EQUALS |'plan-for'(Reactor was shut down), "proper"|}|]|}
{EQUALS |'reason-for',[MONITOR |(NMP Division Director), 'all'(Reactor outage)|], [ENSURE |(Director of NMP), {IMPACTS |{NOTEQUALS |'time-period-of'(Reactor was shut down), "extremely long time"|}, (Supply of nuclear material)|}|]|}
[DIRECTS |(Director of NMP), (NMP Division Director), [UNDERSTAND |(NMP Division Director), 'reason-for'(Reactor was shut down)|]|]
[DIRECTS |(Director of NMP), (NMP Division Director), [DETERMINE |(NMP Division Director), {IMPACTS |(Reactor was shut down), (All reactors)|}|]|]
[DIRECTS |(Director of NMP), (NMP Division Director), [EVALUATES |(NMP Division Director), {LEADTO |(Corrective actions), [RESTART |(Reactor was shut down)|]|}|]|]
[INQUIRES |(Director of NMP), (NMP Division Director), [EVALUATES |(SR), {IMPACTS |(Reactor was shut down), (All reactors)|}|]|]
[IFTHEN:EVALUATES |{EQUALS |'status-of', {WHATIS |'all'(Reactor was shut down)|}, "available"|},

(Director of NMP), 'plan-for',[RESTART |(Reactor was shut down)|]|]
{IFTHEN:IMPACTS |{EQUALS |'time-period-of'(Reactor was shut down), "indeterminate", OR "long-term"|}, (Reactor was shut down), (Supply of plutonium), AND (Supply of tritium)|}
[IFTHEN:FINDS |{IMPLIES |'reason-for'(Reactor was shut down), {EQUALS |'time-period-of'(Reactor was shut down), "indeterminate", OR "long-term"|}|}, (Director of NMP), (Alternative supplies of nuclear material)|]
{DEPENDSON |{IMPACT |(Reactor was shut down), 'what'(Supply of nuclear material)|}, 'what-type-of-charge-was-current'(Reactor was shut down)|}
[CONSIDERS |(Director of NMP), {INCLUDES |(Alternative supplies of tritium), [ACCELERATES |(Accelerated returns from the stockpile)|]|}|]
[CONSIDERS |(Director of NMP), 'means-of',[ACCLERATES |{EQUALS |'status-of'(Corrective actions), "complete"|}, AND [RESTART |(Reactor was shut down)|]|]|]
[ENSURES |(Director of NMP), {EQUALS |'nature-of', {EQUALS |'location-of'(Corrective actions), (All reactors)|}, "appropriate"|}|]
[IFTHEN:CONSIDERS |{EQUALS |'nature-of',{EQUALS |'reason-for'(Reactor was shut down), "problem"|}, "endemic problem"|}, [SHUTDOWN |(Director of NMP), (All reactors)|]|]
{EQUALS |'time-period-of',{EQUALS |'status-of'(All reactors), "shut down"|}, 'time-period-of',{EQUALS |'status-of'(Corrective actions), "not complete"|}|}
[IFTHEN:WORKSWITH |[DECIDES |(Director of NMP), [SHUTDOWN |(All reactors)|]|], (Director of NMP), (OMA), [DETERMINE |{IMPACT |{EQUALS |'status-of'(All reactors), "shut down"|}, (Supply of nuclear material)|}|]|]
[CONSIDERS |(Director of NMP), {EQUALS |'reason-for',[SUPPORT |(Key members of Congress), (Proposal to cut DOEs current budget by 25%)|], "to rid the DOE of waste, fraud, and abuse"|}|]
[BRIEFS |(Director of NMP), {OWNS |(Key members of congress), (Congressional staff)|}, (Proposed budget cut)|]
{EQUALS |'reason-for',[BRIEFS |(Director of NMP), (Congressional staff), (Proposed budget cut)|], [INFORM |(Director of NMP), (Congressional staff), {FUNDEDBY |(NMP programs), (NMPs current budget)|}|]|}
{EQUALS |'reason-for',[BRIEFS |(Director of NMP), (Congressional staff), (Proposed budget cut)|], [INFORM |(Director of NMP), (Congressional staff), {EQUALS |'reason-for'(NMP budget controls), "prevent-waste-fraud-and-abuse"|}|]|}
{EQUALS |'reason-for',[BRIEFS |(Director of NMP), (Congressional staff), (Proposed budget cut)|], [INFORM |(Director of NMP), (Congressional staff), {IMPACTS |(Proposed budget cut), (NMP activities)|}|]|}
[WORKSWITH |(Director of NMP), (DP-50), AND (DOE Congressional Affairs), [ESTABLISH |(Educational process for congressional staff)|]|]
{EQUALS |'reason-for',[ESTABLISH |(Educational process for congressional staff)|], [PRESENT |(Director of NMP), (Congressional staff), 'perspective-of'(Director of NMP), (Proposed budget cut)|]|}
[INFORMS |(Director of NMP), (Congressmen in affected regions), 'ALL'(Proposed budget cut), AND {IMPACT |(Proposed budget cut), (Affected regions)|}|]
[CONSIDERS |(Director of NMP), (Contamination at RFP)|]
{EQUALS |'time-period-of'(Contamination at NMP facilities), "last nine months"|}
{EQUALS |'location-of',{EQUALS |'number-of'(Contamination at NMP facilities), "many"|}, (SR)|}
{IMPLIES |{EQUALS |'visibility-of'(DOE activities), "very high"|}, {EQUALS |'visibility-of'(Contamination at RFP), "very high"|}|}
{IMPLIES |(Contamination at RFP), [IMPROVES |(Director of NMP), (Conduct of operations), (NMP Facilities)|]|}
{EQUALS |'time-period-of',[ESTABLISHES |(Director of NMP), [IMPROVES |(Director of NMP), (Conduct of operations), (NMP Facilities)|]|], "Begun in 1989"|}
{EQUALS |'importance-of'(Contamination at NMP facilities), "very important"|}
{EQUALS |'time-period-of',[DOESNOTINFORM |(Someone), (Director of NMP), (Contamination at NMP

facilities)|], "before 1989"|}
[EVENTHOUGH:EVALUATES |{DOESNOTOWN |(NMP), (RFP)|}, (Director of NMP), {IMPACT |(Contamination at RFP), (NMP facilities)|}|]
[CANNOTINFLUENCE |(Director of NMP), (Media), [REPORTS |(Media), (Contamination at RFP)|]|]
{DOESNOTOWN |(NMP), (RFP)|}
[LEARNSFROM |(Director of NMP), (Contamination at RFP)|]
{IMPACTS |'what',[LEARNSFROM |(Director of NMP), (Contamination at RFP)|], [IMPROVES |(Director of NMP), 'performance-of'(Support contractors), (Contamination at NMP facilities)|]|}
[CONSIDERS |(Director of NMP), (Arms limitation talks)|]
[DIRECTS |(Director of NMP), (Planning Division Director), [WORKWITH |(Planning Division Director), (OMA), [MONITOR |(Arms limitation talks)|]|]|]
[DIRECTS |(Director of NMP), (Planning Division Director), [EVALUATE |{IMPACTS |(Arms limitation talks), (NMP facilities)|}|]|]
[DIRECTS |(Director of NMP), (Planning Division Director), [EVALUATE |{IMPACTS |(Arms limitation talks), (Current supply/demand cases)|}|]|]
[EVALUATES |(Director of NMP), {IMPACTS |(Arms limitation talks), (NMP activities)|}|]
[IFTHEN:DECIDESWITH |{EQUALS |'status-of'(Proposed budget cut), "comes to pass"|}, AND [DECIDES |(Director of NMP), [SHUTDOWN |(NMP facilities)|]|], (Director of NMP), [SHUTDOWN |(NMP facilities)|], [KNOWS |'outcome-of'(Arms limitation talks)|]|]
[DOESNOTWANT |(Director of NMP), [DECIDESWITHOUT |(Director of NMP), [SHUTDOWN |(NMP facilities)|], [KNOWS |'outcome-of'(Arms limitation talks)|]|]|]
[IFTHEN:NEEDS |[DECIDES |(Director of NMP), 'status-of'(NMP facilities)|], (Director of NMP), 'ALL'(Arms limitation talks)|]

B.4.2 Subject 4, Exercise 2

B.4.2.1 Transcript

I think I'd start with the K-reactor is down with problems and the Washington Post article on the internal DOE contractor memo on safety analyses. I think for both of those, I would ask my managers to get a rapid understanding of what the problems are with K-reactor. And understand the basis for the, or the origin of the internal memo, and what the problems were with the safety analyses.
You know when I think about this, in the last exercise, I'm really reacting tactically maybe more than strategically here to handle the problems. I'll pursue that maybe a little later.
From a tactical standpoint, I'd want my managers to quickly get an understanding of what the problems are that caused K-reactor to go down. Not only the immediate problems, but underlying causes, root causes, that kind of thing, and to get a good understanding for the basis for the internal memo. And again similar to the last exercise, the next thing I'd want, once we had an understanding, is to determine the potential impact on P-reactor and L-reactor. Are there deficiencies identified such that they really should also be shut down quickly because of potential safety vulnerabilities. Once we've made that assessment, then really it's focusing on what needs to be done to resolve these problems in a timely manner so that we can resume production. But it's not just these specific problems that were identified, but are there any more deep seated or root causes that will mean that we really need to back off and look at the whole, maybe a more generic situation with these facilities. In other words, do we

need to make some major changes in the way we do business? Or in the safety analyses of the reactors? Or in physical plant? Or all of the above before we can feel confident in operating the reactors to the proper level of safety? That basically would be my reasoning on the reactors.
On the agreement to reduce the number of weapons in Europe, I would ask my program managers to assess the agreement that had been reached by working through the Military Applications people and the DOD to assess the impact on the required supply of nuclear materials and the timing. That could have an impact on the reactor situation. If we're in a situation where we would have to inform the Secretary, for example, of the impact of the downtime for K-reactor or if we have to shut down P and L also, and the impact of that on our current supply/demand situation. And we wouldn't want to do that without taking into consideration the effect of the agreement between President Bush and Gorbachev. Because if there is still a major supply shortfall that would cause a potential problem in maintaining our deterrent, I'd want to be able to inform the Secretary. We would want to have a good assessment of the supply/demand with the impact of the agreement in-order-to assess the cost/benefit or risk/benefit of maybe starting the reactors or operating the reactors before we had done everything that we would like to do to improve the safety or solve the problem.
On the FBI seizure of Rocky Flats Plant I would ask my program managers to stay abreast of the situation at Rocky Flats relative to the cause for the FBI action and the potential impact on the Rocky Flats Plant operations because those operations would impact the need for material. If Rocky Flats is going to shutdown for a significant period of time, that will impact weapons builds, that will impact the need, the timing for the supply of plutonium and tritium. I'd also want to understand what precipitated the FBI action and what potential applicability that may have on our other sites and take corrective action if we think there may be any vulnerability there.

B.4.2.2 Translation

The Director of NMP considers the status of K-reactor being down with problems.
The Director of NMP considers the Washington Post article on the internal DOE contractor memo on safety analyses.
The Director of NMP directs the Reactor Division Director to understand the reason for the status of K-reactor being down with problems.
The Director of NMP directs the Reactor Division Director to understand the origin of the internal memo on safety analyses.
The Director of NMP directs the Reactor Division Director to understand the problems with the internal memo on safety analyses.
The perspective of the Director of NMP is tactical more than the perspective of the Director of NMP is strategic.
The Director of NMP wants the Reactor Division Director to understand the reason for the status of K-reactor being down with problems.
The Director of NMP wants the Reactor Division Director to understand the root causes of the status of K-reactor being down with problems.
The Director of NMP wants the Reactor Division Director to understand the reason for the internal memo on safety analyses.
When the Director of NMP understands the reason for K-reactor being down with problems, the Director of NMP determines the impact of K-reactor being down with problems on P-reactor and L-reactor.
The Director of NMP inquires of someone if the reason for K-reactor being down with problems is potential safety venerabilities which implies the date of the Director of NMP should shut down the other reactors is quickly.
When the Director of NMP evaluates shutting down the other reactors, the Director determines corrective actions to restart the reactors in a timely manner.

If root causes exist, then the Director of NMP considers all NMP activities.
The Director of NMP inquires of someone changes in NMP activities.
The Director of NMP inquires of someone changes in reactor safety analyses.
The Director of NMP inquires of someone changes in the reactors.
The Director of NMP inquires of someone changes in NMP activities, changes in reactor safety analyses, and changes in the reactors before the confidence of the Director of NMP in the safety of the reactors is confident.
The Director of NMP considers the U.S.-Soviet agreement to reduce the number of nuclear weapons in Europe.
The Director of NMP directs NMP Division Director to work with OMA and DOD to evaluate the impact of the U.S.-Soviet agreement on the supply of nuclear material, the demand for nuclear material, and the date of the demand for nuclear material.
The U.S.-Soviet agreement could impact the status of the reactors.
The Director of NMP informs the Secretary of Energy the impact of K-reactor being down, AND potential for shut down of P-reactor and L-reactor on the current supply/demand cases.
The Director of NMP wants the new supply/demand cases to include the impact of the U.S.-Soviet agreement on the current supply/demand cases.
If the new supply/demand cases imply a shortfall the nature of which is a potential problem in the US deterrent, the Director informs the Secretary of Energy all about the new supply/demand cases.
The new supply/demand cases including the U.S.-Soviet agreement enables the Director of NMP to evaluate the risk/benefit of restarting the reactors with the status of the reactors being before desired safety actions completed.
The Director of NMP considers the FBI seizing the Rocky Flats Plant.
The Director of NMP directs the NMP Division Director to monitor RFP relative to the reason for the FBI seizing the RFP.
The Director of NMP directs the NMP Division Director to monitor the impact of the FBI seizing the RFP on the status of RFP.
FBI seizing RFP impacts the demand for nuclear material.
The time period of RFP being shut down is a significant period of time impacts weapons builds which impacts the demand for nuclear material and the date of demand for nuclear material.
The Director of NMP wants to understand the reason for the FBI action.
The Director of NMP wants to understand the impact the FBI action has on other sites.
If vernerabilities exist, the Director of NMP employs corrective action on NMP facilities.

B.4.2.3 Coded Protocol

[CONSIDERS I(Director of NMP), {EQUALS I'status-of'(K-reactor), "down with problems"I}I]
[CONSIDERS I[PUBLISHED I(The Washington Post), (Article on another incident of contamination at Rocky Flats)I]I]
[DIRECTS I(Director of NMP), (NMP Division Director), [UNDERSTAND I(NMP Division Director), 'reason-for',{EQUALS I'status-of'(K-reactor), "down with problems"I}I]I]
[DIRECTS I(Director of NMP), (NMP Division Director), [UNDERSTAND I(NMP Division Director), 'origin-of'(Article on an internal DOE contractor memo about safety analyses)I]I]
[DIRECTS I(Director of NMP), (NMP Division Director), [UNDERSTAND I(NMP Division Director), 'problems-of'(Article on an internal DOE contractor memo about safety analyses)I]I]
{MORETHAN I{EQUALS I'perspective-of'(Director of NMP), "tactical"I}, {EQUALS I'perspective-of'(Director of NMP), "strategic"I}I}
[WANTS I(Director of NMP), [UNDERSTAND I(NMP Division Director), 'reason-for',{EQUALS I'status-of'(K-reactor), "down with problems"I}I]I]

[WANTS |(Director of NMP), [UNDERSTAND |(NMP Division Director), 'root-causes-of',{EQUALS |'status-of'(K-reactor), "down with problems"|}|]|]
[WANTS |(Director of NMP), [UNDERSTAND |(NMP Division Director), 'reason-for',(Internal DOE contractor memo about safety analyses)|]|]
[WHEN:DETERMINES |[UNDERSTANDS |(Director of NMP), 'reason-for',{EQUALS |'status-of'(K-reactor), "down with problems"|}|], (Director of NMP), {IMPACTS |'status-of'(K-reactor), 'status-of'(P-reactor), AND 'status-of'(L-reactor)|}|]
[INQUIRES |(Director of NMP), {IMPLIES |{EQUALS |'reason-for',{EQUALS |'status-of'(K-reactor), "down with problems"|}, "potential safety venerabilities"|}, {EQUALS |'date-of',[SHUTDOWN |(P-reactor), AND (L-reactor)|], "quickly"|}|}|]
[WHEN:DETERMINES |[EVALUATES |(Director of NMP), [SHUTDOWN |(All reactors)|]|], (Director of NMP), {EQUALS |'reason-for'(Corrective actions), {EQUALS |'date-of',[RESTART |(All reactors)|], "timely manner"|}|}|]
[IFTHEN:CONSIDERS |{EQUALS |'existence-of',{WHATIS |'root-causes-of',{EQUALS |'status-of'(K-reactor), "down with problems"|}|}, "exists"|}, (Director of NMP), 'ALL'(NMP activities)|]
[INQUIRES |(Director of NMP), (Someone), 'change-in'(NMP activities)|]
[INQUIRES |(Director of NMP), (Someone), 'change-in'(Reactor safety analyses)|]
[INQUIRES |(Director of NMP), (Someone), 'change-in'(All reactors)|]
[INQUIRES |(Director of NMP), (Someone), {BEFORE |'change-in'(NMP activities), 'change-in'(Reactor safety analyses), AND 'change-in'(All reactors), {EQUALS |'confidence-in'(Director of NMP), (All reactors), "confident"|}|}|]
[CONSIDERS |(Director of NMP), {EQUALS |'existence-of'(Agreement to reduce the number of nuclear weapons in Europe), "exists"|}|]
[DIRECTS |(Director of NMP), (NMP Division Director), [WORKWITH |(NMP Division Director), (OMA), AND (DOD), [EVALUATE |{IMPACT |(U.S.-Soviet agreements), (Supply of nuclear material), AND 'ALL'(Demand for nuclear material)|}|]|]|]
{COULDIMPACT |(Agreement to reduce the number of nuclear weapons in Europe), 'status-of'(All reactors)|}
[INFORMS |(Director of NMP), (Secretary of Energy), {IMPACTS |{EQUALS |'status-of'(K-reactor), "shut down"|}, AND 'potential-for',[SHUTDOWN |(P-reactor), AND (L-reactor)|], (Current supply/demand cases)|}|]
[WANTS |(Director of NMP), {INCLUDES |(New supply/demand cases), {IMPACTS |(Agreement to reduce the number of nuclear weapons in Europe), (Current supply/demand cases)|}|}|]
[IFTHEN:INFORMS |{IMPLIES |(New supply/demand cases), {EQUALS |'nature-of'(Crossover point of all material), "potential problem in US deterrent"|}|}, (Director of NMP), (Secretary of Energy), 'ALL'(New supply/demand cases)|]
{ENABLES |{INCLUDES |(New supply/demand cases), (U.S.-Soviet agreements)|}, [EVALUATES |(Director of NMP), 'risk/benefit-of',[RESTART:WITH |(All reactors), {EQUALS |'status-of'(All reactors), "desired safety actions not complete"|}|]|]|]|}
[CONSIDERS |(Director of NMP), [SEIZED |(FBI), (RFP)|]|]
[DIRECTS |(Director of NMP), (NMP Division Director), [MONITOR |{RELATIVETO |'status-of'(RFP), 'reason-for',[SEIZED |(FBI), (RFP)|]|}|]|]
[DIRECTS |(Director of NMP), (NMP Division Director), [MONITOR |{IMPACTS |[SEIZED |(FBI), (RFP)|], 'status-of'(RFP)|}|]|]
{IMPACTS |[SEIZED |(FBI), (RFP)|], (Demand for nuclear material)|}
{IMPACTS |{EQUALS |'time-period-of',{EQUALS |'status-of'(RFP), "shut down"|}, "significant period of time"|}, {IMPACTS |[BUILDS |(Nuclear weapons)|], (Demand for nuclear material), 'date-of'(Demand for nuclear material)|}|}
[WANTS |(Director of NMP), [UNDERSTAND |'reason-for',[SEIZED |(FBI), (RFP)|]|]|]
[WANTS |(Director of NMP), [UNDERSTAND |{IMPACTS |[SEIZED |(FBI), (RFP)|], (All sites)|}|]|]
[IFTHEN:EMPLOYS |{EQUALS |'existence-of'(Venerabilities), "exists"|}, (Director of NMP), (Corrective

actions), (NMP facilities)l]

B.4.3 Subject 4, Exercise 3

B.4.3.1 Transcript

I think the first thing I'd do is, all the reactors are down at Savannah River, and I would have my program managers work with the site to develop a plan for when the reactor is going to be back up again. I'd meet with the Deputy Assistant Secretary for Military Applications to work with that person to make sure that they understand our plan and work with them to try to minimize the impacts on the weapons production as a result of the reactors being down. I would work with them to try to minimize the impact by, for example, maybe bringing back bottles faster from some of the weapons, reducing the lead time on the bottles in transit, and maybe taking bottles out of weapons that are in the inactive reserve. There are various possibilities of actions to minimize the impact of the reactors being down, and also to give him confidence that we have our act together and a plan in place to get the reactors back up on a certain schedule.

As far as the FMPC situation, that would impact plutonium only, because FMPC only provides targets for the reactors. I would assume we're still in a situation where plutonium, virgin plutonium is needed based on the timing. They stopped all shipments of nuclear materials through the state until FMPC is cleaned up. What I would do there is, probably the most important thing would be to have my program managers explore how we could supply, how we could accelerate processing of plutonium residues and possibly processing of retirements to fill in the gap for virgin plutonium until we can get the situation at Fernald straightened out and get additional targets to Savannah River. But typically we have a fair amount of material in targets ahead of the reactor operations, so we probably wouldn't see an impact for some time. But I would have my program managers look into how we might accelerate certain activities, plutonium residue processing and so on, to accommodate at least some period of time that we will be unable to produce plutonium, because of not having targets from Fernald.

On the Fernald situation, I would want my staff to understand what the real problem is that the governor has with the FMPC, when he states that he wants it cleaned up. What precisely does that mean and how much control do we have over that? I would want to understand what precipitated the decision, the statement and then try to develop a plan to resolve the issue. And that might mean, very likely would mean meeting with state people to get a better understanding of their concerns and present to them then our proposal for resolving their concerns. And in that I think I would attempt to get them to agree to proceed with shipments once we had a plan in place and supported for resolving the concerns that they would have.

Concerning the leak from the tank at FMPC; I would want to understand the cause for that leak. But in a broader context, I would look at are there generic problems at the FMPC that are going to continue that need to be addressed in a generic way. For example, it's interesting you use this example, because we did upgrade and replace the entire tank farm at Fernald, because it was old and it was a major hazard. And I'd want an evaluation of that situation as to whether we have a significant generic problem at the FMPC.

As far as rumors of reorganization, that's normal. That's typical. And I don't see that there's any decision making process there that's required. And if my managers asked me about that, I don't think I would feed the rumors. I think if they asked me what I knew about it, I'd tell them what I knew about it. But my experience is on this, if you try to do your job, people normally take that into consideration.

And on the reactors being down at Savannah River I would again have my program managers develop a plan on how to get those reactors up. And then work with a very high priority to implement it and make sure the DAS for Military Applications was up to speed on it.

B.4.3.2 Translation

The Director of NMP considers the status of all the SR reactors being shut down.
The Director of NMP develops a plan for the SR reactors.
The Director of NMP directs the Reactor Division Director to work with SR to develop a plan for the date of the status of the SR reactors being operating.
The Director of NMP works with the DAS/MA to ensure the DAS/MA understands the plan for restarting the SR reactors.
The Director of NMP works with the DAS/MA to minimize the impact of the status of the reactors being shut down on the production of nuclear weapons.
The Director of NMP works with the DAS/MA to minimize the impact of the status of the reactors being shut down on the production of nuclear weapons.
The Director of NMP considers accelerating weapons returns.
The Director of NMP considers reducing the transportation time of weapons returns.
The Director of NMP considers alternative supplies of tritium includes nuclear weapons whose status is inactive reserve.
The number of actions is various that minimize the impact of the reactors being down on nuclear weapons production.
The actions impart confidence in the DAS/MA of NMP activities and that the Director of NMP owns a plan for the date of restarting the SR reactors being a certain schedule.
Because the only material flow of FMPC is reactor targets, the situation at FMPC impacts the supply of plutonium.
The Director of NMP needs reactor production of plutonium.
The Director of NMP considers the governor of Ohio stopped all shipments of nulcear materials through the state until FMPC is cleaned up.
The Director of NMP directs the NMP Division Director to determine alternative supplies of plutonium to include accelerating plutonium scrap recovery, and processing of retired weapons.
The time period of alternative supplies of plutonium equals the time period of corrective actions at FMPC and production of reactor targets for SR.
The level of the inventory of reactor targets at SR is typically a fair amount ahead of reactor operations which implies the time period of no impact of the FMPC status on SR reactors is some time.
The Director of NMP directs the NMP Division Director to evaluate NMP activities, and accelerating plutonium scrap recovery.
The reason for accelerating alternative supplies of plutonium is to minimize the impact of the no targets from FMPC implies no new plutonium on the supply of plutonium.
The Director directs staff to understand the reason for the governor of Ohio's actions.
The Director of NMP inquires of staff the meaning of cleaned up.
The Director of NMP inquires of staff the control of the Director of NMP over the meaning of cleaned up.
The Director of NMP wants to understand the reason for the Governor of Ohio's actions.
The Director of NMP develops a plan to resolve the governor's concerns.
The Director of NMP meets with Ohio officials to understand the governor's concerns.
The Director of NMP informs with Ohio officials of the plan for resolving the governor's concerns.
When a plan for resolving the governor's concerns exists, the Director of NMP would try to get Ohio officials to agree for the Director of NMP to ship nulcear materials through the state.
The Director of NMP wants to understand the reason for the leak from one of the tanks at FMPC.

The Director of NMP inquires of someone if the nature of problems at FMPC is generic which implies the time period of problems at FMPC is continues.
Because the age of all tanks at FMPC was old, and the nature of all tanks at FMPC was a major hazard, the Director of NMP replaced all tanks at FMPC.
The Director of NMP directs someone to evaluate the nature of problems at FMPC being generic.
The occurrence of rumors of reorganization is normal.
The Director of NMP does not decide about rumors of reorganization.
If NMP Division Director inquires of the Director of NMP about rumors of reorganization, the Director of NMP does not feed the rumors of reorganization.
If NMP Division Director inquires of the Director of NMP about rumors of reorganization, the Director of NMP informs the NMP Division Director all about rumors of reorganization.
The experience of the Director of NMP is people consider the Director of NMP tries to do his job.
The Director of NMP considers the status of the SR reactors being shut down.
The Director of NMP directs the Reactor Division Director to develop a plan for restarting the SR reactors.
The priority of implementing the plan for restarting the SR reactors is very high.
The Director of NMP ensures the DAS/MA understands the plan for restarting the SR reactors.

B.4.3.3 Coded Protocol

[CONSIDERS I(Director of NMP), {EQUALS I'status-of'(SR reactors), "shut down"I}I]
[DEVELOPS I(Director of NMP), 'plan-for'(SR reactors)I]
[DIRECTS I(Director of NMP), (Reactor Division Director), [WORKSWITH I(Reactor Division Director), (SR), [DEVELOPS I'plan for',{WHATIS I'date-of',{EQUALS I'status-of'(SR reactors), "operating"I}I}I]I]I]
[WORKSWITH I(Director of NMP), (DAS/MA), [ENSURE I(Director of NMP), [UNDERSTANDS I(DAS/MA), 'plan-for',[RESTARTS I(SR reactors)I]I]I]I]
[WORKSWITH I(Director of NMP), (DAS/MA), [MINIMIZE I{IMPACTS I{EQUALS I'status-of'(SR reactors), "shut down"I}, [PRODUCES I(DAS/MA), (Nuclear weapons)I]I}I]I]
[WORKSWITH I(Director of NMP), (DAS/MA), [MINIMIZE I{IMPACTS I{EQUALS I'status-of'(SR reactors), "shut down"I}, [PRODUCES I(DAS/MA), (Nuclear weapons)I]I}I]I]
[CONSIDERS I(Director of NMP), [ACCELERATES I(Weapons returns)I]I]
[CONSIDERS I(Director of NMP), [REDUCING I'transportation-time-of'(Weapons returns)I]I]
[CONSIDERS I(Director of NMP), {INCLUDES I(Alternative supplies of tritium), {EQUALS I'status-of'(Nuclear weapons), "inactive reserve"I}I}I]
[MINIMIZE I{EQUALS I'number-of'(Actions), "various"I}, {IMPACTS I{EQUALS I'status-of'(SR reactors), "shut down"I}, [PRODUCES I(DAS/MA), (Nuclear weapons)I]I}I]
[IMPART I(Actions), 'confidence-in'(DAS/MA), (NMP activities), AND [OWNS I(Director of NMP), 'plan-for',{EQUALS I'date-of',[RESTARTS I(SR reactors)I], "certain schedule"I}I]I]
{BECAUSE:IMPACTS I{EQUALS I'material-flow-of'(FMPC), (Plutonium targets)I}, [STOPPED I(Governor of Ohio), (Shipments of nuclear materials through Ohio)I], (Supply of plutonium)I}
[NEEDS I(Director of NMP), (Reactor production of plutonium)I]
[CONSIDERS I(Director of NMP), [STOPPED I(Governor of Ohio), (Shipments of nuclear materials through Ohio)I]I]
[DIRECTS I(Director of NMP), (NMP Division Director), [DETERMINES I(NMP Division Director), {INCLUDES I(Alternative supplies of plutonium), (Accelerated plutonium scrap processing), AND (Processing of retired weapons)I}I]I]
{EQUALS I'time-period-of'(Alternative supplies of plutonium), 'time-period-of'(Corrective actions at FMPC), AND 'time-period-of',[PRODUCES I(FMPC), (Plutonium targets)I]I}
{IMPLIES I{EQUALS I'amount-of',{EQUALS I'inventory-of'(SR), (Plutonium targets)I}, "typically a fair

amount ahead of reactor operations"|}, {EQUALS l'time-period-of',{NOIMPACT l'status-of'(FMPC), (SR)|}, "some time"|}|]

[DIRECTS |(Director of NMP), (NMP Division Director), [EVALUATES |(NMP Division Director), (NMP activities), AND (Accelerated plutonium scrap processing)|]|]

{EQUALS l'reason-for'(Accelerated plutonium scrap processing), [MINIMIZE |{IMPACTS |{IMPLIES l'status-of'(FMPC), {EQUALS l'status-of'(Reactor production of plutonium), "none"|}|}, (Supply of plutonium)|}|]|}

[DIRECTS |(Director of NMP), (Staff), [UNDERSTANDS |(Staff), 'reason-for'(Governor of Ohios actions)|]|]

[INQUIRES |(Director of NMP), (Staff), 'governors-definition-of'(Cleaned-up)|]

[INQUIRES |(Director of NMP), (Staff), {WHATIS l'influence-of'(Director of NMP), 'governors-definition-of'(Cleaned-up)|}|]

[WANTS |(Director of NMP), [UNDERSTANDS l'reason-for'(Governor of Ohios actions)|]|]

[DEVELOPS l'plan-for',[RESOLVES |(Director of NMP), (Governor of Ohios concerns)|]|]

[MEETSWITH |(Director of NMP), (Ohio officials), [UNDERSTANDS |(Director of NMP), (Governor of Ohios concerns)|]|]

[INFORMS |(Director of NMP), (Ohio officials), 'plan-for',[RESOLVES |(Director of NMP), (Governor of Ohios concerns)|]|]

[WHEN:GETAGREEMENT |{EQUALS l'existence-of', {WHATIS l'plan-for',[RESOLVES |(Director of NMP), (Governor of Ohios concerns)|]|}, "exists"|}, (Director of NMP), (Ohio officials), [SHIP |(Director of NMP), (Shipments of nuclear materials through Ohio)|]|]

[WANTS |(Director of NMP), [UNDERSTANDS l'reason-for'(Leak from one of the tanks at FMPC)|]|]

[INQUIRES |(Director of NMP), (Someone), {IMPLIES |{EQUALS l'nature-of'(Problems at FMPC), "generic"|}, {EQUALS l'time-period-of'(Problems at FMPC), "continues"|}|}|]

[BECAUSE:REPLACED |{EQUALS l'age-of'(Tanks at FMPC), "old"|}, AND {EQUALS l'nature-of'(Tanks at FMPC), "major hazard"|}, (Tanks at FMPC)|]

[DIRECTS |(Director of NMP), (Someone), [EVALUATES |(Someone), {EQUALS l'nature-of'(Problems at FMPC), "generic"|}|]|]

{EQUALS l'occurrence-of',{WHATIS l'rumors-about'(Plans for reorganization of DOE)|}, "normal"|}

[DOESNOTDECIDE |(Director of NMP), 'rumors-about'(Plans for reorganization of DOE)|]

[IFTHEN:DOESNOTFEED |[INQUIRES |(NMP Division Director), (Director of NMP), 'rumors-about'(Plans for reorganization of DOE)|], (Director of NMP), 'rumors-about'(Plans for reorganization of DOE)|]

[IFTHEN:INFORMS |[INQUIRES |(NMP Division Director), (Director of NMP), 'rumors-about'(Plans for reorganization of DOE)|], (Director of NMP), (NMP Division Director), [KNOWS |(Director of NMP), 'rumors-about'(Plans for reorganization of DOE)|]|]

{EQUALS l'experience-of'(Director of NMP), [CONSIDER |(People), (Person trying to do his job)|]|}

[CONSIDERS |(Director of NMP), {EQUALS l'status-of'(SR reactors), "shut down"|}|]

[DIRECTS |(Director of NMP), (Reactor Division Director), [DEVELOPS |(Reactor Division Director), 'plan-for',[RESTARTS |(SR reactors)|]|]|]

{EQUALS l'priority-of',[IMPLEMENTING |(Director of NMP), 'plan-for',[RESTARTS |(SR reactors)|]|], "very high"|}

[ENSURES |(Director of NMP), [UNDERSTANDS |(DAS/MA), 'plan-for',[RESTARTS |(SR reactors)|]|]|]

B.4.4 Subject 4, Exercise 4

B.4.4.1 Transcript

Since George Bush really didn't enunciate any major policy changes, I'm not sure that the election would really impact my approach, except that he did make a big speech and say he was going to listen to his career managers and take their advice on what to do. Now if the Secretary was a Bush appointee and DOE environmental managers having won an internal battle, that would certainly say the Secretary was going to be very conscious about the environmental impacts of DOE defense operations. So that certainly would be a message. So I would tell my managers, my staff, that we needed to, now that we've fought the battle and lost, we needed to get in there and get on with the required environmental review of our reactors to satisfy the Secretary and the DOE environmental side of the house to demonstrate that we could operate those reactors in an environmentally acceptable manner. I would also instruct my managers on the other facilities that while the first focus was on the reactors, that we could expect a similar assessment or review on the other facilities and that we ought to get in and do that review ourselves, i.e., do an internal, self-assessment on our other facilities before we were told to shut them down for some kind of an external review.
I would want to go ahead and initiate the review and a plan to resolve any environmental issues that would need to be resolved before the reactors could be restarted. But I would want to emphasize with the field and the contractor that we needed to cooperate with the DOE environmental side of the house in conducting whatever reviews they were going to conduct and to quickly establish an action plan. In fact, as we find out deficiencies, we ought to develop the plan and start working on correcting those deficiencies and not wait until the end.
Some congressmen are still pushing a new production reactor capability. I would support that independent of the current status of our reactors, because the reactors are old and the country needs a new production reactor capability. And I would support that activity.
You must testify before the House Armed Services Committee about your ability to meet national security requirements. I would ask the planning staff, based on what we know of the environmental review, the potential results of that review and the corrective actions, to assess the supply/demand situation and again I would ask my staff to develop options. We would work with Military Applications to determine the impact of the potential shortfalls we would have in material supply and what the options are that we would be pursuing to minimize those. And have my staff put together a briefing for the Committee that would basically lay this information out for the Committee. And I would have to get that briefing approved by upper management, Congressional Affairs, and OMB before going forward to the Committee. So it would have to be done at an appropriate time.

B.4.4.2 Translation

Because President Bush did not enunciate change in major administrative policies, the presidential elections does not impact NMP activities.
The Director of NMP considers if President Bush appointed the Secretary of Energy.
DOE environmental managers won the internal battle implies the Secretary of Energy is concerned about the impact of NMP facilities on the environment.
The Director of NMP informs NMP Division Director since we lost the battle, the date of NMP must conduct the environmental review is now.

NMP conducts the environmental review in order to satisfy the Secretary of Energy and DOE environmental managers that quality of NMP operating reactors is environmentally acceptable.
The environmental review of the reactors implies an environmental review of other NMP facilities.
The Director of NMP directs NMP Division Director to conduct an environmental review on other NMP facilities before someone shuts down other NMP facilities.
The Director of NMP initiates an internal environmental review and a plan for resolving environmental issues before restarting the reactors.
The Director of NMP emphasizes to SR and the contractor to work with DOE environmental managers on the environmental review.
The Director of NMP emphasizes to SR and the contractor to establish a plan for corrective actions quickly.
As problems are identified, NMP develops a plan for solving problems and works on solving problems.
NMP does not wait for all problems to be identified before solving problems.
Some congressmen are still pushing a new production reactor capability.
Because of the status of all reactors and the age of the reactors being old, and the country needs a new production reactor capability, the Director of NMP supports the new production reactor capability.
The Director of NMP supports the new production reactor capability.
The Director of NMP considers testifying before the House Armed Services Committee about NMP's ability to meet national security requirements.
The Director of NMP directs the Planning Division Director to evaluate new supply/demand cases including the environmental review, the outcomes of the environmental review, and corrective actions.
The Director of NMP directs the NMP Division Director to determine options for dealing with the incidents.
The Director of NMP works with OMA to determine the impact of status of all reactors on the crossover point of all material.
The Director of NMP works with OMA to determine options for minimizing the impact of the status of all reactors on the demand for nuclear materials.
The Director of NMP directs staff to prepare a briefing for HASC all about the options for minimizing the impact of the status of all reactors on the demand for nuclear materials.
The Director of NMP obtains approval of superiors, DOE Congressional Affairs, and OMB before testifying before HASC.
The date of staff preparing a briefing for HASC would be an appropriate time.

B.4.4.3 Coded Protocol

{BECAUSE:NOIMPACT |[DIDNOTENUNCIATE |(President Bush), 'change-in'(Major administrative policies)|], (Presidential elections), (NMP activities)|}
[CONSIDERS |(Director of NMP), [APPOINTED |(President Bush), (Secretary of Energy)|]|]
{EQUALS |'who-won',[DISAGREE |(Director of NMP), (DOE environmental managers), 'status-of'(All reactors)|], (DOE environmental managers)|}
[BECAUSE:INFORMS |{EQUALS |'who-lost',[DISAGREE |(Director of NMP), (DOE environmental managers), 'status-of'(All reactors)|], (NMP)|}, (NMP Division Director), {EQUALS |'date-of',[CONDUCTS |(NMP), (Environmental review)|], "now"|}|]
{EQUALS |'reason-for',[CONDUCTS |(NMP), (Environmental review)|], [SATISFY |(NMP), (Secretary of Energy), AND (DOE Environmental Managers), {EQUALS |'quality-of',[OPERATES |(NMP), (All reactors)|], "environmentally acceptable"|}|]|}
{IMPLIES |{OF |(Environmental review), (All reactors)|}, {OF |(Environmental review), (Other NMP facilities)|}|}
[DIRECTS |(Director of NMP), (NMP Division Director), [BEFORE:CONDUCTS |[SHUTSDOWN |(Someone), (Other NMP facilities)|], [CONDUCTS |(NMP), {OF |(Environmental review), (Other NMP facilities)|}|]|]|]

[INITIATES |(Director of NMP), (Environmental review), AND 'plan-for',[BEFORE:RESOLVES |[RESTARTS |(Director of NMP), (All reactors)|], (Director of NMP), (Environmental issues)|]|]
[EMPHASIZES |(Director of NMP), (SR), AND (Support contractors), [WORKSWITH |(SR), AND (Support contractors), (DOE Environmental Managers), (Environmental review)|]|]
[EMPHASIZES |(Director of NMP), (SR), AND (Support contractors), {EQUALS |'date-of',[ESTABLISHES |(Director of NMP), 'plan-for'(Corrective actions)|], "quickly"|}|]
[WHEN:DEVELOPSANDSOLVES |{EQUALS |'status-of'(Problem), "identified"|}, 'plan-for',[SOLVES |(Problem)|], (Problem)|]
[DOESNOTWAIT:BEFORESOLVING |(Director of NMP), {EQUALS |'status-of'(All problems), "identified"|}, (Problem)|]
[CONSIDERS |(Director of NMP), [SUPPORT |(Some congressmen), (New production reactor capability)|]|]
[BECAUSEOF:SUPPORTS |{EQUALS |'status-of'(All reactors), "shut down"|}, {EQUALS |'age-of'(All reactors), "old"|}, AND [NEEDS |(United States), (New production reactor capability)|], (Director of NMP), (New production reactor capability)|]
[SUPPORTS |(Director of NMP), (New production reactor capability)|]
[CONSIDERS |(Director of NMP), [WILLTESTIFY |(Director of NMP), (HASC), (NMPs ability to meet national security requirements)|]|]
[DIRECTS |(Director of NMP), (Planning Division Director), [EVALUATE |{INCLUDES |(New supply/demand cases), (Environmental review), 'outcome-of'(Environmental review), AND (Corrective actions)|}|]|]
[DIRECTS |(Director of NMP), (NMP Division Director), [DETERMINE |(NMP Division Director), (Options for dealing with incidents)|]|]
[WORKSWITH |(Director of NMP), (OMA), [DETERMINE |{IMPACTS |{EQUALS |'status-of'(All reactors), "shut down"|}, (Crossover point of all material)|}|]|]
[WORKSWITH |(Director of NMP), (OMA), [DETERMINE |'Options-for',[MINIMIZES |{IMPACTS |{EQUALS |'status-of'(All reactors), "shut down"|}, (Crossover point of all material)|}|]|]|]
[DIRECTS |(Director of NMP), (Staff), [PREPARE |(Staff), {INCLUDES |(Testimony for HASC), 'Options-for',[MINIMIZES |{IMPACTS |{EQUALS |'status-of'(All reactors), "shut down"|}, (Crossover point of all material)|}|]|]|]|]
[BEFORE:OBTAINSAPPROVAL |[WILLTESTIFY |(Director of NMP), (HASC), (NMPs ability to meet national security requirements)|], (Director of NMP), (Superiors), (DOE Congressional Affairs), AND (OMB)|]
{EQUALS |'date-of',[PREPARES |(Staff), (Testimony for HASC)|], "an appropriate time"|}

B.4.5 Subject 4, Exercise 5

B.4.5.1 Transcript

Considering the WIPP item; it's not under NMP. It never was under NMP. On the WIPP item, I would ask my staff to work with EM, or whoever the organization was at the time in 1989, (NM) to find out what the true situation is on WIPP and to identify impacts, if any, on our facilities by a delayed WIPP schedule. And also, impacts, if any, on Military Applications facilities which could then impact on our situation.

On the issue of reactor restart for the environmental review, I would proceed until a firm task force for reactor restart has been implemented. I would proceed similar to the way I mentioned in the previous exercise with the review and initiating a plan for corrective actions to meet any concerns identified in the environmental review. Concerning the task force for restarting the reactors, I would support a separate, permanent, reactor organization to give the reactors the proper attention and visibility that they've needed all along and haven't gotten. I would recommend that the reorganization report at a fairly high level in the DP organization. We proposed that back in 1989. And that the organization be staffed appropriately to give the reactors the kind of attention that they really have needed for a long time.

On the SIS technologies, if there was a major break-through in SIS technologies, I would ask my staff to evaluate the impact of those break-through's on the schedule for implementation of SIS and the cost for implementation of SIS, and then factor that into a decision on whether or not the SIS implementation should be accelerated in favor of, or instead of continued virgin plutonium production and blending at Savannah River. It must also be factored it into the overall supply/demand situation to see whether there's any basis for accelerating SIS implementation.

On the last point there are at least two new stockpile cases a week because of the anticipated U.S.-Soviet agreements resulting from Bush-Gorbachev talks. We would need to stay abreast of the potential arms control agreements and the range of impacts that it might have on us and factor that into our supply/demand evaluations. For example, if most of the new stockpile cases showed that we had enough plutonium, then whether we had a break-through or not in SIS, we probably wouldn't want to push any kind of acceleration until we had a firm reading on an arms control agreement. And they certainly would impact the urgency with which we would attempt to restart the reactors also. If they tended to say that we no longer had a shortfall in 7 years, and not only that, but we could afford some additional downtime in the reactors, then that would factor into the urgency with which we would go about restarting the reactors in light of any environmental deficiencies that were identified.

So really, we would be doing a lot of evaluations to see the impacts of these various situations on our supply/demand situation so that we could factor that into decision making process on our facilities.

B.4.5.2 Translation

The Director of NMP considers the status of WIPP being no where near the estimated time.
NMP does not own WIPP.
The time period of NMP owns WIPP is never in the past.
The Director of NMP directs his staff to work with EM to determine the true status of WIPP.
The Director of NMP directs his staff to work with EM to determine the impact of the date of startup of WIPP being delayed on NMP activities.
The Director of NMP directs his staff to work with EM to determine the impacts of the date of startup of WIPP being delayed on OMA facilities which impacts NMP activities.
The Director of NMP considers the reason for the status of all reactors being down being an environmental review.
The Director of NMP contiues NMP activities until the status of the special task force for restarting the reactors is implemented.
The Director of NMP conducts the environmental review.
The Director of NMP initiates a plan for corrective actions the nature of which is to resolve environmental issues resulting from the environmental review.
The Director of NMP considers the special task force for restarting all the reactors.
The Director of NMP supports a reactor organization the nature of which is separate and permanent.
The reason for the Director of NMP supporting a reactor organization is to provide resources for all reactors which are proper.

The Director of NMP recommends the level of the reactor organization be a fairly high level in DP.
The date of the Director of NMP recommends the level of the reactor organization be a fairly high level in DP was in 1989.
The Director of NMP recommends the staff of the reactor organization is appropriate to provide the reactors with the attention they have needed but not received.
The Director of NMP considers a recent report on major, SIS break-through's by one of his division directors.
If the truth of the report on major, SIS break-through's is true, the Director of NMP directs his staff to evaluate the impact of the report on major, SIS break-through's on the date of implementing SIS and the cost of implementing SIS.
The Director of NMP decides about accelerating the implementation of SIS instead of reactor production of plutonium and blending at SR.
The Director of NMP evaluates the new supply/demand cases including the report on major, SIS break-through's in order to decide about accelerating SIS implementation.
The Director of NMP considers the number of new stockpile cases being two per week.
The Director of NMP considers the reason for the number of new stockpile cases being two per week being the U.S.-Soviet agreements.
The Director of NMP monitors U.S.-Soviet agreements.
The Director of NMP monitors the range of impacts of U.S.-Soviet agreements on NMP activities.
The Director of NMP evaluates the new supply/demand cases including U.S.-Soviet agreements.
If the new supply/demand cases include a crossover point of all material that doesn't exist, and the report on major, SIS break-through's is true, the Director of NMP does not accelerate SIS until the nature of U.S.-Soviet agreements is firm.
U.S.-Soviet agreements impact the urgency of restarting the reactors.
The supply of nuclear material sufficiently exceeding the demand for nuclear material impacts the urgency of restarting the reactors with the existence of environmental issues.
The Director of NMP evaluates the impact of incidents on the current supply/demand cases to support deciding about the status of NMP facilities.

B.4.5.3 Coded Protocol

[CONSIDERS I(Director of NMP), {EQUALS I'status-of'(WIPP), "nowhere near the estimated time"I}I]
{DOESNOTOWN I(NMP), (WIPP)I}
{EQUALS I'time-period-of',{OWNS I(NMP), (WIPP)I}, "never in the past"I}
[DIRECTS I(Director of NMP), (Staff), [WORKSWITH I(Staff), (EM), [DETERMINES I'status-of'(WIPP)I]I]I]
[DIRECTS I(Director of NMP), (Staff), [WORKSWITH I(Staff), (EM), [DETERMINE I{IMPACTS I{EQUALS I'date-of',[STARTSUP I(WIPP)I], "delayed"I}, (NMP activities)I}I]I]I]
[DIRECTS I(Director of NMP), (Staff), [WORKSWITH I(Staff), (EM), [DETERMINE I{IMPACTS I{IMPACTS I{EQUALS I'date-of',[STARTSUP I(WIPP)I], "delayed"I}, (OMA activities)I}, (NMP activities)I}I]I]I]
[CONSIDERS I(Director of NMP), {EQUALS I'reason-for',[SHUTDOWN I(Secretary of Energy), (All reactors)I], "environmental review"I}I]
[CONTINUES:UNTIL I(Director of NMP), (NMP activities), {EQUALS I'status-of'(Special task force for restarting all the reactors), "implemented"I}I]
[CONDUCTS I(Director of NMP), (Environmental review)I]
[INITIATES I(Director of NMP), [RESOLVES I'plan-for'(Corrective actions), {FROM I(Environmental issues), (Environmental review)I}I]I]
[CONSIDERS I(Director of NMP), (Special task force for restarting all the reactors)I]
[SUPPORTS I(Director of NMP), {EQUALS I'nature-of'(Reactor organization), "separate", AND

"permanent"|}|]
{EQUALS l'reason-for',[SUPPORTS |(Director of NMP), (Reactor organization)|], [PROVIDES |(Reactor organization), {EQUALS l'nature-of'(Resources), "proper"|}|]|}
[RECOMMENDS |(Director of NMP), {EQUALS l'level-of'(Reactor organization), "fairly high level in DP"|}|]
{EQUALS l'date-of',[RECOMMENDS |(Director of NMP), {EQUALS l'level-of'(Reactor organization), "fairly high level in DP"|}|], "1989"|}
[RECOMMENDS |(Director of NMP), {IMPLIES |{EQUALS l'staff-of'(Reactor organization), "appropriate"|}, [PROVIDES |(Reactor organization), (All reactors), "attention they have needed but not received"|]|}|]
[CONSIDERS |(Director of NMP), [PUBLISHED |(NMP Division Director), (Report on major, SIS break-throughs)|]|]
[IFTHEN:DIRECTS |{EQUALS l'truth-of'(Report on major, SIS break-throughs), "true"|}, (Director of NMP), (Staff), [EVALUATES |{IMPACTS |(Report on major, SIS break-throughs), 'date-of',[IMPLEMENTS |(SIS)|], AND 'cost-of',[IMPLEMENTS |(SIS)|]|}|]|]
[DECIDES |(Director of NMP), {INSTEADOF |[ACCELERATES |[IMPLEMENTS |(SIS)|]|], (Reactor production of plutonium), AND (Blending of plutonium at SR)|}|]
[SUPPORTS |[EVALUATES |(Director of NMP), {INCLUDES |(New supply/demand cases), (Report on major, SIS break-throughs)|}|], [DECIDES |(Director of NMP), [ACCELERATES |(SIS)|]|]|]
[CONSIDERS |(Director of NMP), {EQUALS l'number-of'(New stockpile cases), "two per week"|}|]
[CONSIDERS |(Director of NMP), {EQUALS l'reason-for'(New stockpile cases), [SUSPECTS |(Someone), {EQUALS l'potential-for'(U.S.-Soviet agreements), "likely"|}|]|}|]
[MONITORS |(Director of NMP), (U.S.-Soviet agreements)|]
[MONITORS |(Director of NMP), {IMPACTS |(U.S.-Soviet agreements), (NMP activities)|}|]
[EVALUATES |(Director of NMP), {INCLUDES |(New supply/demand cases), (U.S.-Soviet agreements)|}|]
[IFTHEN:DOESNOTACCELERATE:UNTIL |{DOESNOTINCLUDE |(New supply/demand cases), (Crossover point of all material)|}, AND {EQUALS l'truth-of'(Report on major, SIS break-throughs), "true"|}, (SIS), {EQUALS l'nature-of'(U.S.-Soviet agreements), "firm"|}|]
{IMPACTS |(U.S.-Soviet agreements), 'urgency-of',[RESTARTS |(All reactors)|]|}
{IMPACTS |{SUFFICENTLYEXCEEDS |(Supply of nuclear material), (Demand for nuclear material)|}, 'urgency-of',[RESTARTSWITH |(All reactors), {EQUALS l'existence-of'(Environmental issues), "exists"|}|]|}
[SUPPORTS |[EVALUATES |(Director of NMP), {IMPACTS |(Incidents), (Current supply/demand cases)|}|], [DECIDES |(Director of NMP), 'status-of'(NMP facilities)|]|]

B.5 Subject 5

B.5.1 Subject 5, Exercise 1

B.5.1.1 Transcript

I think I'd first ask my Deputy to go back and do a little more research on what he's just told me. We've got to have a few more facts on what just shut down. Whether it's a long-term thing, short-term, or immediate. Is it something that's going to be worked through in a very short period of time? Probably what I would do is I would alert my next level management of what I was just told about this specific issue. Then I would wait for this more detailed report. And I can vision the classic telephone call to upper management and then we put together a fact sheet on what's happened. And we'd get the input from Savannah River with some sort of prognosis of what it means.
I guess I would just note the Gorbachev and Bush issue because, if you think you're going to be short in 7 years, and discussions are going on on strategic arms limitations, many times problems that we forecast based on a current stockpile case probably won't be, will never come to fruition.
Regarding the issue of key members of congress are pushing to cut DOE's budget to rid it of waste, fraud, and abuse, I guess on a separate front I would have been trying to understand what particular things they were talking about. Hopefully we would have something, if they've made some sort of news release or some sort of statements, we would know what they were talking about. And I would hope it wouldn't be affecting my Nuclear Materials Production Program. And therefore, it would be a key question as to where they see the waste occurring.
I would be interested in the incident of contamination at Rocky Flats. The whole process of how we take problems from one site and compare it to another site and make sure we don't have common problems has been something people have been asking us to pay a lot more attention to. So I'd be trying to figure out what is the incident of contamination. Asking Savannah River to talk with Rocky Flats and see if there's any spill-over of that kind of thing that might happen at Savannah River. That's probably where I would stop. I would have to hold for some additional information before I did anything global here.

B.5.1.2 Translation

The nature of the reactor was shut down is a basic issue.
The Director of NMP directs the Deputy Director to inquire all about the reactor that was shut down.
The Director of NMP needs facts on what reactor was shut down.
The Director of NMP inquires of the Deputy Director if the time period of the reactor being shut down is long-term.
The Director of NMP inquires of the Deputy Director if the time period of the reactor being shut down is short-term.
The Director of NMP informs his superiors all about the reactor being shut down.
The Director of NMP waits for detailed information about the reactor being shut down.
When SR informs the Director of NMP the detailed information about the reactor being shut down, the

Director of NMP prepares a fact sheet on the reactor being shut down.
The Director of NMP inquires of SR the evaluation of the reactor being shut down.
The Director of NMP considers the arms limitation talks.
The Director of NMP considers the crossover point of all materials is seven years and the time period of arms limitation talks is now.
The number of times problems based on the current stockpile case do not occur is many.
The Director of NMP considers key members of congress support cutting DOE's budget to rid DOE of waste, fraud, and abuse.
The Director of NMP wants to understand the particular issues of the key congressmen.
If key congressmen have published press releases or made statements, then the Director of NMP would know the particular issues of the key congressmen.
The Director of NMP hopes the proposed budget cuts have no impact on NMP's current budget.
The Director of NMP inquires of someone the perspective of key congressmen on waste in the DOE's current budget.
The level of interest of the Director of NMP in the contamination at RFP is interested.
People are directing the Director of NMP to consider the implications of problems at one site on other sites to ensure common problems do not exist.
The Director of NMP determines all about the contamination at RFP.
The Director of NMP directs SR to work with RFP to determine the impact of the contamination at RFP on SR.
The Director of NMP waits for detailed information about the incidents before making decisions of a global nature.

B.5.1.3 Coded Protocol

{EQUALS l'nature-of'(Reactor was shut down), "basic issue"l}
[DIRECTS l(Director of NMP), (Deputy Director of NMP), [INQUIRES l(Deputy Director of NMP), (SR), 'ALL'(Reactor was shut down)l]l]
[NEEDS l(Director of NMP), 'facts-about'(Reactor was shut down)l]
[INQUIRES l(Director of NMP), (Deputy Director of NMP), {EQUALS l'time-period-of'(Reactor was shut down), "long-term"l}l]
[INQUIRES l(Director of NMP), (Deputy Director of NMP), {EQUALS l'time-period-of'(Reactor was shut down), "short-term"l}l]
[INFORMS l(Director of NMP), (Superiors), 'ALL'(Reactor was shut down)l]
[WAITS l(Director of NMP), {EQUALS l'existence-of',{WHATIS l'detailed-information-about'(Reactor was shut down)l}, "exists"l}l]
[WHEN:PREPARES l[INFORMS l(SR), (Director of NMP), {WHATIS l'detailed-information-about'(Reactor was shut down)l}l], (Director of NMP), (Fact sheet), (Reactor was shut down)l]
[INQUIRES l(Director of NMP), (SR), [EVALUATES l(SR), (Reactor was shut down)l]l]
[CONSIDERS l(Director of NMP), [MEETING l(President Bush), (Gorbachov), (Arms limitation talks)l]l]
[CONSIDERS l(Director of NMP), {EQUALS l'date-of'(Crossover point of all material), "seven years"l}, AND {EQUALS l'date-of'(Arms limitation talks), "now"l}l]
{EQUALS l'number-of',[DONOTOCCUR l'problems-of'(Current stockpile case)l], "many"l}
[CONSIDERS l(Director of NMP), {EQUALS l'reason-for',[SUPPORT l(Key members of Congress), (Proposal to cut DOEs current budget by 25%)l], "to rid the DOE of waste, fraud, and abuse"l}l]
[WANTS l(Director of NMP), [UNDERSTANDS l(Director of NMP), 'particular-issues-of'(Key members of congress)l]l]
[IFTHEN:KNOWS l[MADE l(Key members of congress), (Press announcement), OR (Statements)l], (Director of NMP), 'particular-issues-of'(Key members of congress)l]

[HOPES |(Director of NMP), {NOIMPACT |(Proposed budget cut), (NMPs current budget)|}|]
[INQUIRES |(Director of NMP), (Someone), {WHATIS |'perspective-of'(Key members of congress), {WHATIS |'budget-waste-in'(DOEs current budget)|}|}|]
{EQUALS |'level-of-interest'(Director of NMP), (Contamination at RFP), "interested"|}
[DIRECTS |(People), (Director of NMP), {EQUALS |'reason-for',[EVALUATES |(Director of NMP), {IMPACTS |'problems-of'(One site), (Other sites)|}|], [ENSURE |(Director of NMP), {EQUALS |'existence-of'(Endemic problems), "dont exist"|}|]|}|]
[DETERMINES |(Director of NMP), 'ALL'(Contamination at RFP)|]
[DIRECTS |(Director of NMP), (SR), [WORKSWITH |(SR), (RFP), [DETERMINES |{IMPACTS |(Contamination at RFP), (SR)|}|]|]|]
[WAITSFOR:DECIDES |(Director of NMP), {EQUALS |'existence-of',{WHATIS |'detailed-information-about'(Incidents)|}, "exists"|}, {EQUALS |'nature-of'(Something), "global"|}|]

B.5.2 Subject 5, Exercise 2

B.5.2.1 Transcript

Well I guess the first thing I've got to figure out is whether the article true. We're having all kinds of problems with articles that are published and you find out they're only half true, or they're out of date. So, the first thing I've got to do is get on top of the article so I can figure out what we've got here. If this were in the morning newspaper, I would have probably picked up the telephone and called the Field Office Manager and asked him what he knows about such a memo. I probably would have just gone directly to Savannah River myself. I think one of the problems we have, that we're all aware of, is the fact that the reactors are not designed to today's standards. If we built them over again, we wouldn't build them like they are. At first brush, this may be one of those factual statements that is perfectly true, but when you look at probability of risk and all that stuff, it's not as big a problem. Certainly we would have built them differently. I would have probably made my phone call and I would have understood the difference between what this means. But again if this is the issue of a containment dome versus not having containment at Savannah River, it's kind of an old issue. And therefore, I would have tried to, hopefully, figure out how relevant this thing is. So the first thing I would do is try to figure that out. And then depending on what I found out, I'd figure out where we're going. If it's a problem that it's inadequate, if it's truly inadequate, then we would wind up doing something, you know one of the questions we'd raise is, whether we can operate these reactors safely. So, the new culture says you've got to make sure that you know whether you've really got a safety problem, and if you do, that comes before your concerns about what your stockpile and supply case say. So, first of all, I'd get the facts on the situation.
-END OF EXERCISE AND BEGINNING OF PART II-
The thing that jumped out at me is that I need to figure out what is the safety analysis they're talking about. I'd like to get a report back on that so I could decide if that's significant or not, so I could tell where I can go from there. I guess you reminded me that K is still down with problems and I guess I'm continuing to get some sort of update on what that is so I can continue to factor that in, as to whether that's a bad situation. I probably recognize the Rocky Flats thing as being something that relieves some pressure possibly on at least parts of my operation. If there's an indication here that Rocky Flats won't need plutonium, I'd probably want to know a little bit of background of what's going on there and a

little more about what I'm told here. I'd like to know, because I know this was an alleged ES&H violation. And that tells me, depending on what they did there, that we may be doing something similar at some of the other sites.
The Gorbachev and Bush thing, somewhere along the line, we would have tried to figure out whether this really has any impact on us. But that's primarily a weapons activity and they can be feeding back into my staff as to what that might mean to the supply/demand situation. Many times we've had situations where reducing the number of nuclear weapons in Europe has not meant a whole lot to us if the argument is we still need them someplace else.

B.5.2.2 Translation

The Director of NMP determines if the article on an internal DOE contractor memo about safety analyses is true.
The media publishes articles on problems that are half truths and on problems that are old.
Knowing all about the article on an internal DOE contractor memo on safety analyses implies the Director of NMP can determine the problems.
If the Director of NMP read the article on safety analyses in the morning newspaper, the Director of NMP inquires of the Manager of SR all about the DOE contractor memo on safety analyses.
The quality of the design of all the reactors is not up to today's standards.
If the date of building all the reactors equals today, then the design of all the reactors would be different.
The truth of the article on reactor safety analyses may be true.
The Director of NMP may have determined the problems of reactor safety analyses to not equal a big problem in light of risk/benefit analyses.
If the date of building all the reactors equals today, then the design of all the reactors would be different.
The date of the Director of NMP inquires of the Manager of SR all about the DOE contractor memo on safety analyses is past which implies the Director of NMP knows the problems of the reactor safety analyses.
If the problem with the reactor safety analyses is containment domes at SR then the date of the problem with the reactor safety analyses is old.
The Director of NMP determines the relevancy of the DOE contractor memo on safety analyses.
Depending on the results of determining the relevancy of the DOE contractor memo on safety analyses, the Director of NMP determines NMP activities.
If the adequacy of the reactor safety analyses is inadequate, then the Director of NMP acts on something.
Operating the reactors depends on the safety of the reactors.
The Director of NMP must know if a safety problem exists.
Safety problems are a higher priority than providing nuclear material for the current stockpile case.
The Director of NMP obtains the facts about the article on safety analyses.
The Director of NMP determines all about the article on safety analyses.
The Director of NMP wants all the information about the reactor safety analyses to enable the Director of NMP to determine NMP activities.
The Director of NMP considers the status of K-reactor being down with problems.
The Director of NMP inquires all about the status of K-reactor to enable the Director of NMP to determine the nature of the problem with K-reactor.
The status of RFP reduces pressure on some of NMP activities.
The FBI seizing RFP implies reduction in the demand for plutonium.
The Director of NMP wants to know all about the FBI seizing RFP.
The reason for the FBI seizing RFP is alleged ES&H violations.
The Director of NMP inquires of someone if the problems at RFP exist at other sites.
The Director of NMP considers the agreement between President Bush and Gorbachov.

The Director of NMP determines the impact of the agreement to reduce the number of nuclear weapons in Europe on NMP activities.
The agreement to reduce the number of nuclear weapons in Europe impacts OMA activities.
The Director of NMP directs his staff to work with OMA to determine the impact of the agreement to reduce the number of nuclear weapons in Europe on the current supply/demand case.
Many times if the argument is the nuclear weapons are needed somewhere else, there has been minimal impact of an agreement to reduce the number of nuclear weapons in Europe on NMP activities.

B.5.2.3 Coded Protocol

[DETERMINES I(Director of NMP), {EQUALS I'truth-of'(Article on an internal DOE contractor memo about safety analyses), "true"I}I]
[PUBLISHES I(Media), {EQUALS I'truth-of',{OF I(Articles), (DOE problems)I}, "half true"I}, AND {EQUALS I'date-of'(DOE problems), "old"I}I]
{IMPLIES I[KNOWS I(Director of NMP), 'ALL'(Article on an internal DOE contractor memo about safety analyses)I], [DETERMINE I(Director of NMP), (Problem)I]I}
[IFTHEN:INQUIRES I{EQUALS I'date-of',[READS I(Director of NMP), (Article on an internal DOE contractor memo about safety analyses)I], "in the morning newspaper"I}, (Director of NMP), (Plant Manager at SR), 'ALL'(Reactor safety analyses)I]
{EQUALS I'safety-of',{WHATIS I'design-of'(All reactors)I}, "inadequate by todays standards"I}
{IFTHEN:EQUALS I{EQUALS I'date-of',[BUILDS I(All reactors)I], "today"I}, {EQUALS I'design-of'(All reactors), "different"I}I}
{EQUALS I'truth-of'(Article on an internal DOE contractor memo about safety analyses), "true"I}
[DETERMINES:INLIGHTOF I(Director of NMP), {DOESNOTEQUAL I'problems-of'(Reactor safety analyses), "big problem"I}, 'risk/benefit-of'(Reactor safety analyses)I]
{IFTHEN:EQUALS I{EQUALS I'date-of',[BUILDS I(All reactors)I], "today"I}, {EQUALS I'design-of'(All reactors), "different"I}I}
{IMPLIES I{EQUALS I'date-of',[INQUIRES I (Director of NMP), (Plant Manager at SR), 'ALL'(Reactor safety analyses)I], "past"I}, [KNOWS I(Director of NMP), 'problems-of'(Reactor safety analyses)I]I}
{IFTHEN:EQUALS I{EQUALS I'problems-of'(Reactor safety analyses), "no containment domes at SR"I}, 'date-of',{WHATIS I'problems-of'(Reactor safety analyses)I}, "old"I}
[DETERMINES I(Director of NMP), 'relevancy-of'(Internal DOE contractor memo about safety analyses)I]
[DEPENDSON:DETERMINES I{WHATIS I'outcome-of',[DETERMINES I(Director of NMP), 'relevancy-of'(Internal DOE contractor memo about safety analyses)I]I}, (Director of NMP), (NMP activities)I]
[IFTHEN:ACTS I{EQUALS I'adequacy-of'(Reactor safety analyses), "inadequate"I}, (Director of NMP), (Something)I]
{DEPENDSON I[OPERATES I(All reactors)I], 'safety-of'(All reactors)I}
[MUSTKNOW I(Director of NMP), {EQUALS I'existence-of'(Safety problem), "exists"I}I]
{HIGHERTHAN I'priority-of'(Safety problem), 'priority-of',[PROVIDESFOR I(Director of NMP), (Nuclear material), (Current stockpile case)I]I}
[OBTAINS I(Director of NMP), 'facts-about'(Article on an internal DOE contractor memo about safety analyses)I]
[DETERMINES I(Director of NMP), 'ALL'(Article on an internal DOE contractor memo about safety analyses)I]
[BEFORE:DETERMINES I[WANTS I(Director of NMP), 'ALL'(Reactor safety analyses)I], (Director of NMP), (NMP activities)I]
[CONSIDERS I(Director of NMP), {EQUALS I'status-of'(K-reactor), "down with problems"I}I]
[BEFORE:DETERMINES I[INQUIRES I(Director of NMP), (SR), 'ALL',{EQUALS I'status-of'(K-reactor), "down with problems"I}I], (Director of NMP), 'nature-of',{WHATIS I'problems-of'(K-reactor)I}I]

[REDUCESPRESSUREON I'status-of'(RFP), 'some-of'(NMP activities)I]
{IMPLIES I[SEIZED I(FBI), (RFP)I], [REDUCES I(Demand for plutonium)I]I}
[WANTS I(Director of NMP), [KNOWS I(Director of NMP), 'ALL',[SEIZED I(FBI), (RFP)I]I]I]
{EQUALS I'reason-for',[SEIZED I(FBI), (RFP)I], "alleged ES&H violations"I}
[INQUIRES I(Director of NMP), (Someone), {EQUALS I'nature-of',{WHATIS I'problems-of'(RFP)I}, 'nature-of',{WHATIS I'problems-of'(Other sites)I}I}I]
[CONSIDERS I(Director of NMP), {EQUALS I'parties-in-agreement'(Agreement to reduce the number of nuclear weapons in Europe), "President Bush", AND "Gorbachov"I}I]
[DETERMINES I(Director of NMP), {IMPACTS I(Agreement to reduce the number of nuclear weapons in Europe), (NMP activities)I}I]
{IMPACTS I(Agreement to reduce the number of nuclear weapons in Europe), (OMA activities)I}
[DIRECTS I(Director of NMP), (Staff), [WORKSWITH I(Staff), (OMA), [DETERMINES I{IMPACTS I(Agreement to reduce the number of nuclear weapons in Europe), (Current supply/demand cases)I}I]I]I]
{EQUALS I'number-of',{IFTHEN:MINIMALIMPACT I{EQUALS I'need-for'(Nuclear weapons), "needed somewhere else"I}, (Agreement to reduce the number of nuclear weapons in Europe), (NMP activities)I}, "many times"I}

B.5.3 Subject 5, Exercise 3

B.5.3.1 Transcript

This is pretty real. Let me think. Well, it says all the reactors are down at Savannah River. We don't know how long. We know that we just stopped; the governor has just stopped our shipments. Let's see. I guess first of all, I probably would share this at least with my Deputy--all that has happened here. We need to talk about all this. I'm supposed to be operating, but production is not the biggest worry we have now. So therefore, this displeasure with you for not being able to produce enough material to meet peg points is probably from an old Deputy Assistant Secretary, so therefore, that is not a big issue. The thing we're supposed to be doing is to get on top of things so we can get things working again. And I assume I've got all my staff members trying to resolve the problems with the Savannah River reactors. And I've got whomever my FMPC person is, I've got them hot on the leak in the tank. And therefore, we've been talking to Congressional Affairs about the shipments of nuclear materials. But I'm not sure that's the world's biggest crisis because FMPC doesn't really doesn't play in our production all that much anymore. So I guess this one isn't quite as clear. We have rumors all the time of re-organizations. Depending on how long it's been since I have had a staff meeting, I might just have a little meeting and tell everybody about some of this stuff and kind of calm their fears on it. And remind them that what we're trying to do is to get things done right. And
I assume I know about this leak at FMPC and I've already got people working on it. But I can't really tell from all this. So that's kind of where I am from all this.
-END OF PART I-
I'm still kind of tending to dismiss this internal peer discussion I've had with this Military Application person. As I've said, that's not our biggest priority. So I'm not really worrying about that too much. There's rumors every day of re-organization, so I don't, although I'm not surprised by this one, unless we've talked about it at the staff meeting and my supervisors ask me, I guess I'm going to allay the fears of the staff of whatever's being passed on. I guess I would continue to follow up on what the Savannah

River status is and how that's going and what we're doing about it. I assume it's obviously very critical and we're under a lot of pressure as indicated by the peer discussion I had here. But still I'm supposed to do this in a scientific, logical way. So I'm keeping track of it so I may get the Savannah River status. I assume I knew about this leak in the FMPC tank and I'm getting some sort of data report, status on that. But then again, I'm not sure how. I'll stop there.

B.5.3.2 Translation

The Director of NMP considers the incidents.
The Director of NMP considers the status of all the SR reactors being shut down.
The Director of NMP does not know the time period of all the SR reactors being shut down.
The Director of NMP knows the governor of Ohio stopped shipments of nuclear materials through the state.
The Director of NMP informs the Deputy Director of NMP all about the incidents.
The Director of NMP needs to talk with the Deputy Director of NMP.
The responsibilities of the Director of NMP includes operating NMP facilities.
Operating NMP facilities is not the biggest problem right now.
The perspective of the DAS/MA probably equals old.
The DAS/MA expressing displeasure with the Director of NMP is not a big issue.
The responsibilities of the Director of NMP include understanding the problems of NMP and restoring the status of NMP facilities to opertaing.
The Director of NMP directs his staff to resolve the problems of the SR reactors.
The Director of NMP directs his staff to resolve the problems of the leak in one of the tanks at FMPC.
The Director of NMP works with DOE Congressional Affairs on the governor of Ohio's actions.
Because the nature of the material flow of FMPC is not all that critical, the severity of the status of FMPC is not the world's biggest crisis.
The occurrence of rumors about reorganization of DOE is all the time.
Depending on the date of the Director of NMP meeting with his staff, the Director of NMP would meet with his staff to inform them all about rumors of reorganization and calm the fears of the staff.
The Director of NMP reminds staff the responsiblities of NMP include the quality of doing something is right.
The Director of NMP knows all about the leak from one of the tanks at FMPC.
The Director of NMP directs staff to resolve problems of the leak from one of the tanks at FMPC.
The Director of NMP dismisses the DAS/MA expressing displeasure with the Director of NMP.
Producing nuclear materials is not the highest priority which implies the perspective of the Director of NMP is not to worry.
The occurrence of rumors of reorganization is every day.
The perspective of the Director of NMP about the rumors of reorganization is not surprised.
Unless the Director of NMP has talked with his superiors about the plans for reorganization of DOE, the Director of NMP meets with his staff and calms their fears of the rumors of reorganization.
The Director of NMP monitors the status of the SR reactors.
The Director of NMP monitors the plan for resolving the problems with the SR reactors.
The production of the SR reactors is critical.
The DAS/MA statements imply the existence of pressure to restart the SR reactors.
The nature of restarting the SR reactors is scientific and logical.
SR informs the Director of NMP all about the status of the SR reactors.
The Director of NMP knows all about the leak from one of the tanks at FMPC.
The staff informs the Director of NMP the status of the leak from one of the tanks at FMPC.

B.5.3.3 Coded Protocol

[CONSIDERS I(Director of NMP), (Incidents)I]
[CONSIDERS I(Director of NMP), {EQUALS I'status-of'(SR reactors), "shut down"I}I]
[DOESNOTKNOW I(Director of NMP), 'time-period-of',{EQUALS I'status-of'(SR reactors), "shut down"I}I]
[KNOWS I(Director of NMP), [STOPPED I(Governor of Ohio), (Shipments of nuclear materials through Ohio)I]I]
[INFORMS I(Director of NMP), (Deputy Director of NMP), 'ALL'(Incidents)I]
[NEEDS I(Director of NMP), [TALKSWITH I(Director of NMP), (Deputy Director of NMP)I]I]
{INCLUDES I'responsibilities-of'(Director of NMP), [OPERATES I(Director of NMP), (NMP facilities)I]I}
{EQUALS I'time-period-of',{EQUALS I'problems-of',[OPERATES I(Director of NMP), (NMP facilities)I], "not the biggest problem"I}, "right now"I}
{EQUALS I'perspective-of'(DAS/MA), "old"I}
{EQUALS I'problems-of',[EXPRESSEDDISPLEASURE I(DAS/MA), (Director of NMP)I], "not a big issue"I}
{INCLUDES I'responsibilities-of'(Director of NMP), [UNDERSTANDS I(Director of NMP), 'problems-of'(NMP)I], AND [RESTORING I{EQUALS I'status-of'(NMP facilities), "operating"I}I]I}
[DIRECTS I(Director of NMP), (Staff), [RESOLVES I(Staff), 'problems-of'(SR reactors)I]I]
[DIRECTS I(Director of NMP), (Staff), [RESOLVES I(Staff), 'problems-of'(Leak from one of the tanks at FMPC)I]I]
[WORKSWITH I(Director of NMP), (DOE Congressional Affairs), (Governor of Ohios actions)I]
{BECAUSE:EQUALS I{EQUALS I'nature-of'(Shipments needed from FMPC), "not all that critical"I}, 'severity-of',{WHATIS I'status-of'(FMPC), "not the worlds biggest crisis"I}I}
{EQUALS I'occurrence-of',{WHATIS I'rumors-about'(Plans for reorganization of DOE)I}, "all the time"I}
[DEPENDINGON:MEETSWITH I{WHATIS I'date-of',[MEETSWITH I(Director of NMP), (Staff)I]I}, (Director of NMP), (Staff), [INFORMS I(Director of NMP), (Staff), 'ALL',{WHATIS I'rumors-about'(Plans for reorganization of DOE)I}I], AND [CALMS I'fears-of'(Staff)I]I]
[INFORMS I(Director of NMP), (Staff), {INCLUDES I'responsibilities-of'(NMP), {EQUALS I'quality-of',[DOES I(Something)I], "right"I}I}I]
[KNOWS I(Director of NMP), 'ALL'(Leak from one of the tanks at FMPC)I]
[DIRECTS I(Director of NMP), (Staff), [RESOLVES I(Staff), 'problem-of'(Leak from one of the tanks at FMPC)I]I]
[DISMISSES I(Director of NMP), [EXPRESSEDDISPLEASURE I(DAS/MA), (Director of NMP)I]I]
{IMPLIES I{EQUALS I'priority-of',[PRODUCES I(Nuclear material)I], "not the highest"I}, {EQUALS I'perspective-of'(Director of NMP), "not worried"I}I}
{EQUALS I'occurrence-of',{WHATIS I'rumors-about'(Plans for reorganization of DOE)I}, "every day"I}
{EQUALS I'perspective-of'(Director of NMP), {WHATIS I'rumors-about'(Plans for reorganization of DOE)I}, "not surprised"I}
[UNLESS:MEETSWITH I[TALKEDWITH I(Director of NMP), (Superiors), (Plans for reorganization of DOE)I], (Director of NMP), (Staff), [CALMS I(Director of NMP), 'fears-of'(Staff)I]I]
[MONITORS I(Director of NMP), 'status-of'(SR reactors)I]
[MONITORS I(Director of NMP), 'plan-for',[RESOLVES I'problems-of'(SR reactors)I]I]
{EQUALS I'need-for',{WHATIS I'production-of'(SR reactors)I}, "critical"I}
{IMPLIES I(DAS/MA statements), {EQUALS I'existence-of',{WHATIS I'pressures-of',[RESTARTS I(SR reactors)I]I}, "exists"I}I}
{EQUALS I'nature-of',[RESTARTS I(SR reactors)I], "scientific", AND "logical"I}
[INFORMS I(SR), (Director of NMP), 'ALL',{WHATIS I'status-of'(SR reactors)I}I]
[KNOWS I(Director of NMP), 'ALL'(Leak from one of the tanks at FMPC)I]
[INFORMS I(Staff), (Director of NMP), 'status-of'(Leak from one of the tanks at FMPC)I]

B.5.4 Subject 5, Exercise 4

B.5.4.1 Transcript

I guess my immediate problem that I see in this one... I've got to prepare testimony for the House Armed Services Committee and explain to them where we are and explain the Secretary's philosophy of operations.These weren't building on each other, right? This one's all by itself. So therefore, I don't have any Gorbachev and any of that stuff. All this is totally independent.
My immediate problem is to get the staff together and let's strategize how we're going to respond to this idea of testifying. And we're obviously going to have to draw heavily from the Secretary's statements of why he decided to shut the reactors all down for an environmental review. Hopefully I've made input into those statements. I'm sure I'll be asked to say how long we can expect this environmental review to take. And so therefore, let me just hypothesize for a moment... I need to know what the impact of that decision is as far as how long it will take so that I can take that data and feed it into my testimony. So when I talk about our meeting National Security requirements, I have some idea of what we're talking about there.
I need to continue to show my curves on new production reactor capability and the logic of when that's likely to come on-line. So I guess my immediate problem right now is we need to make sure we understand the Secretary's decision so that we can factor that into my testimony.
-END OF PART I-
First of all I want to find out more about this environmental review. I want to make sure we have an understanding of what that means. How long it's likely to take. All that stuff. I'd want to make sure I've seen what the House Armed Services Committee has sent over requesting us to testify. I need to start working the staff to understand the specifics that they want covered in the testimony. So we need something that deals with the letter of invitation. And then start the staff process of getting the information as to specifically what the congressmen want to hear about. Typically the staff are the ones who usually know really what the specific issues are. I probably already know this, but need to double check about the congressmen involved: who the committee is, how does the committee feel about the new production reactor. Are there any of the congressmen on the committee that are pushing it? Or do we have a different set of people involved? I need congressional background information concerning the NPR program. I assume with presidential elections over, all that says, is that George Bush is continuing with the Ronald Reagan agenda so that didn't really change too many things as far as my previous stockpile scenario situation that I had over here. And basically where we think we're all going.

B.5.4.2 Translation

The nature of preparing testimony for HASC is an immediate problem.
The testimony for HASC includes explaining the status of NMP and the philosophy of operations of the Secretary of Energy.
The nature of the Director of NMP meeting with the staff to determine a strategy for preparing testimony for HASC is an immediate problem.
The testimony for HASC draws heavily from the Secretary's statements about the reason for shutting down

the reactors for an environmental review.
The Director of NMP was involved in the Secretary of Energy deciding to shut down all the reactors.
HASC will inquire of the Director of NMP the time period of the environmental review.
The Director of NMP needs to know the time period of the environmental review to inform HASC of the time period of the environmental review in the testimony for HASC.
The Director of NMP needs to know the impact of the environmental review on NMP's ability to meet National Security Requirements to inform HASC of NMP's ability to meet National Security Requirements.
The Director of NMP informs HASC of the new supply/demand cases including the new production reactor capability and the probability of the date of new production reactor capability being on line being likely.
The nature of the Director of NMP needs to understand the Secretary of Energy shut down all reactors to include in the testimony for HASC is an immediate problem.
The Director of NMP wants to determine all about the environmental review.
The Director of NMP wants to ensure the Director of NMP understands the impact of the environmental review on NMP activities.
The Director of NMP inquires the time period of the environmental review.
The Director of NMP wants to review the HASC letter of invitation.
The Director of NMP works with congressional staff to determine the particular issues of HASC to include in the testimony for HASC.
The Director of NMP needs to deal with the HASC letter of invitation.
The Director of NMP directs the staff to obtain all the information about the particular issues of HASC.
The nature of the congressional staff knows the particular concerns of HASC is typical.
The Director of NMP inquires of congressional staff the feelings of HASC about the new production reactor capability.
The Director of NMP inquires of congressional staff if some of the key congressmen supporting the new production reactor capability are members of HASC.
The Director of NMP inquires of congressional staff if none of the key congressmen supporting the new production reactor capability are members of HASC.
The Director of NMP wants background information of congressmen in reference to new production reactor capability.
The presidential elections are over implies President Bush is continuing with the Ronald Reagan agenda.
The presidential elections have no impact on the current stockpile case.

B.5.4.3 Coded Protocol

{EQUALS I'nature-of',[PREPARES I(Director of NMP), (Testimony for HASC)I], "immediate problem"I}
{INCLUDES I(Testimony for HASC), [EXPLAINS I(Director of NMP), (HASC), 'status-of'(NMP activities), AND 'philosophy-of-operations-of'(Secretary of Energy)I]I}
{EQUALS I'nature-of',[MEETSWITH I(Director of NMP), (Staff), [DETERMINE I'strategy-for',[PREPARES I(Director of NMP), (Testimony for HASC)I]I]I], "immediate problem"I}
{DRAWSHEAVILYFROM I(Testimony for HASC), {PERTAININGTO I(Secretary of Energys statements), {EQUALS I'reason-for',[SHUTDOWN I(Secretary of Energy), (All reactors)I], "environmental review"I}I}I}
[INVOLVEDIN I(Director of NMP), [DECIDES I[SHUTDOWN I(Secretary of Energy), (All reactors)I]I]I]
[WILLINQUIRE I(HASC), (Director of NMP), 'time-period-of'(Environmental review)I]
[NEEDS:INFORM I(Director of NMP), [KNOWS I'time-period-of'(Environmental review)I], (Director of NMP), (HASC), {INCLUDES I(Testimony for HASC), 'time-period-of'(Environmental review)I}I]
[NEEDS:INFORM I(Director of NMP), {IMPACTS I(Environmental review), (NMPs ability to meet national

security requirements)|}, (Director of NMP), (HASC), {INCLUDES |(Testimony for HASC), (NMPs ability to meet national security requirements)|}|]
[INFORMS |(Director of NMP), (HASC), {INCLUDES |(New supply/demand cases), (New production reactor capability)|}, AND {EQUALS |'probability-of',{WHATIS |'date-of',{EQUALS |'status-of'(New production reactor capability), "on-line"|}|}, "likely"|}|]
{EQUALS |'nature-of',{INCLUDES |(Testimony for HASC), [NEEDS |(Director of NMP), [UNDERSTAND |'ALL',[SHUTDOWN |(Secretary of Energy), (All reactors)|]|]|]|}, "immediate problem"|}
[WANTS |(Director of NMP), [DETERMINES |'ALL'(Environmental review)|]|]
[WANTS |(Director of NMP), [ENSURES |(Director of NMP), [UNDERSTANDS |(Director of NMP), {IMPACTS |(Environmental review), (NMP activities)|}|]|]|]
[INQUIRES |(Director of NMP), (Someone), 'time-period-of'(Environmental review)|]
[WANTS |(Director of NMP), [REVIEWS |(Director of NMP), (HASC letter of invitation)|]|]
[WORKSWITH |(Director of NMP), (Congressional staff), [DETERMINES |{INCLUDES |(Testimony for HASC), 'particular-issues-of'(HASC)|}|]|]
[NEEDS |(Director of NMP), [DEALSWITH |(Director of NMP), (HASC letter of invitation)|]|]
[DIRECTS |(Director of NMP), (Staff), [OBTAINS |(Staff), 'ALL',{WHATIS |'particular-issues-of'(HASC)|}|]|]
{EQUALS |'nature-of',[KNOWS |(Congressional staff), 'particular-issues-of'(HASC)|], "typical"|}
[INQUIRES |(Director of NMP), (Congressional staff), {OF |'feelings-of'(HASC), (New production reactor capability)|}|]
[INQUIRES |(Director of NMP), (Someone), {MEMBERSOF |'some-of',[SUPPORT |(Some congressmen), (New production reactor capability)|], (HASC)|}|]
[INQUIRES |(Director of NMP), (Someone), {EQUALS |'number-of',{MEMBERSOF |'some-of',[SUPPORT |(Some congressmen), (New production reactor capability)|], (HASC)|}, "none"|}|]
[WANTS |(Director of NMP), {INREFERENCETO |'background-information-of'(Congressmen), (New production reactor capability)|}|]
{IMPLIES |{EQUALS |'who-won'(Presidential elections), (President Bush)|}, [CONTINUES |(President Bush), 'agenda-of'(Ronald Reagan)|]|}
{NOIMPACT |(Presidential elections), (Current stockpile case)|}

B.5.5 Subject 5, Exercise 5

B.5.5.1 Transcript

Let me get absolutely picky with this situation here. First of all WIPP is not under the Director of the Office of Nuclear Materials Production. So WIPP is not my program to worry about specifically. Although waste that I generate will wind up going there. So that's kind of a nice information for the Office of Defense Waste to worry about, not me. As I said, it could impact me, but as of right this minute, it doesn't. I still have enough storage on my site as opposed to the Director of the Office of Military Application, who may have a problem.
Let's see, all the reactors have been shut down. On that one, I assume I've been part of the, I've been consulted on this idea of creating a special task force, I assume I have, and therefore I've played in this thing. So I kind of understand what that means.
A recent report by one of your staff indicates major break-through's in SIS technologies. SIS is a long-term solution to things so I think that's great. But that's not an immediate problem solver. And it is good as I said earlier, in all probability whatever crisis I have in the supply/demand tends to go away with each continuing discussion with the Soviets. So I guess we'll just kind of continue to do things. What am I going to tell the managers to do and how will this affect NMP's normal operating strategies. I've got to think about this a little bit more.
I guess I should be having them think about their storage requirements on-site. Just how much longer can we continue? What might that mean?
-END OF PART I-
I'd just kind of like to have a quick look at our storage capacities at our NMP sites. We are continuing as it tells me here, we are continuing to do our processing operations and so we are continuing to generate things. I don't think the WIPP is an immediate crisis. But I'd just kind of like to know that. I guess I'll turn around and make the reverse decision that I wasn't directly involved in the special task force for restarting them and therefore, I would like to have some sort of assessment as to what the special task force means. As far as how long they may be shut down.
On the major break-through on SIS technology, I'd like to have a brief write-up of what that's about. Although I'm skeptical of any kind of major break-through.
I want to look at the stockpile curves that are evolving from these Bush / Gorby discussions.

B.5.5.2 Translation

The Director of NMP does not own WIPP.
The level of interest of the Director of NMP in WIPP is doesn't worry about it.
WIPP will receive TRU waste from SR.
Because EM owns WIPP, the level of interest of EM is worried about it.
The status of WIPP could impact NMP activities.
The time period of no impact of WIPP on NMP activities is right now.
The amount of TRU waste storage space at NMP facilities is enough.
The amount of TRU waste storage space at OMA facilities is may not be enough.
The Director of NMP considers the status of all reactors being shut down.
The Secretary of Energy worked with the Director of NMP on creating the special task force for restarting all the reactors.

The Director of NMP understands the special task force for starting all the reactors.
The Director of NMP considers the recent report by an NMP Division Director on major, SIS break-through's.
The nature of SIS is a long-term solution.
The perspective of the Director of NMP on the report on major, SIS break-through's is great.
The Director of NMP considers the recent report by an NMP Division Director on major, SIS break-through's.
The nature of SIS is not an immediate solution.
With the time period of arms limitation talks being continues, the problems of the current stockpile case reduces.
The Director of NMP decides to continue with NMP activities.
The Director of NMP directs his staff to evaluate the TRU waste storage space at NMP sites and the need for TRU waste storage space at NMP sites.
The Director of NMP directs his staff to evaluate the TRU waste storage space at NMP sites and the need for TRU waste storage space at NMP sites.
The status of separations facilities being operating implies NMP is producing nuclear materials.
The severity of the date of WIPP being on-line is no where near the estimated time is not an immediate crisis.
The Secretary of Energy did not work with the Director of NMP on creating the special task force for restarting all the reactors.
The Director of NMP wants someone to evaluate the impact of the special task force for restarting all the reactors on the time period of the reactors being shut down.
The Director of NMP does not believe the report on major, SIS break-through's.
The Director of NMP wants all information about the report on major, SIS break-through's.
The Director of NMP wants to review the new stockpile cases resulting from the arms limitation talks.

B.5.5.3 Coded Protocol

{DOESNOTOWN |(Director of NMP), (WIPP)|}
{EQUALS |'level-of-interest'(Director of NMP), (WIPP), "does not worry about it"|}
{WILLRECEIVE |(WIPP), (SR), (TRU waste)|}
{BECAUSE:EQUALS |{OWNS |(EM), (WIPP)|}, 'level-of-interest'(EM), (WIPP), "worried about it"|}
{IMPACTS |'status-of'(WIPP), (NMP activities)|}
{EQUALS |'time-period-of',{NOIMPACT |'status-of'(WIPP), (NMP activities)|}, "right now"|}
{EQUALS |'amount-of',{OF |(TRU waste storage space), (NMP facilities)|}, "enough"|}
{EQUALS |'amount-of',{OF |(TRU waste storage space), (OMA facilities)|}, "may not be enough"|}
[CONSIDERS |(Director of NMP), {EQUALS |'status-of'(All reactors), "shut down"|}|]
[WORKEDWITH |(Secretary of Energy), (Director of NMP), [CREATE |(Secretary of Energy), (Special task force for restarting all the reactors)|]|]
[UNDERSTANDS |(Director of NMP), 'ALL'(Special task force for restarting all the reactors)|]
[CONSIDERS |(Director of NMP), [PUBLISHED |(NMP Division Director), (Report on major, SIS break-throughs)|]|]
{EQUALS |'nature-of'(SIS), "long-term solution"|}
{EQUALS |'perspective-of'(Director of NMP), (Report on major, SIS break-throughs), "great"|}
[CONSIDERS |(Director of NMP), [PUBLISHED |(NMP Division Director), (Report on major, SIS break-throughs)|]|]
{EQUALS |'nature-of'(SIS), "not an immediate solution"|}
[WITH:REDUCES |{EQUALS |'time-period-of'(Arms limitation talks), "continuing"|}, 'problems-of'(Current stockpile case)|]
[DECIDES |(Director of NMP), [CONTINUES |(NMP activities)|]|]
[DIRECTS |(Director of NMP), (Staff), [EVALUATES |(Staff), {OF |(TRU waste storage space), (NMP facilities)|}, AND 'need-for',{OF |(TRU waste storage space), (NMP facilities)|}|]|]

[DIRECTS |(Director of NMP), (Staff), [EVALUATES |(Staff), {OF |(TRU waste storage space), (NMP facilities)|}, AND 'need-for',{OF |(TRU waste storage space), (NMP facilities)|}|]|]
{IMPLIES |{EQUALS |'status-of'(Separations facilities), "operating"|}, {EQUALS |'time-period-of',[PRODUCES |(NMP), (Nuclear material)|], "still"|}|}
{EQUALS |'severity-of',{EQUALS |'status-of'(WIPP), "nowhere near the estimated time"|}, "not an immediate crisis"|}
[DIDNOTWORKWITH |(Secretary of Energy), (Director of NMP), [CREATE |(Secretary of Energy), (Special task force for restarting all the reactors)|]|]
[WANTS |(Director of NMP), [EVALUATES |(Someone), {IMPACTS |(Special task force for restarting all the reactors), {EQUALS |'time-period-of'(All reactors), "shut down"|}|}|]|]
[DOESNOTBELIEVE |(Director of NMP), (Report on major, SIS break-throughs)|]
[WANTS |(Director of NMP), 'ALL'(Report on major, SIS break-throughs)|]
[WANTS |(Director of NMP), [REVIEWS |,{EQUALS |'reason-for'(New stockpile cases), [SUSPECTS |(Someone), {EQUALS |'potential-for'(U.S.-Soviet agreements), "likely"|}|]|}|]|]

APPENDIX C. LISTS OF UNIQUE UNITS OF INFORMATION

Coding the sentences in the translations created the coded protocols shown in Appendix B, *Transcripts, Translations, and Coded Protocols.* The coding syntax identified each unit of information by type--values, attributes, entities, relationships, and operators. Steps in the coding process were taken to ensure each unit of information identified was unique so that no two units of information represented the same value, attribute, entity, relationship, or operator. The most common problem in ensuring the uniqueness of the units of information was different spellings or wordings. For example, "The Director of NMP" and "Director of NMP" refer to the same thing in reality, but existed in the coded protocols at one time.

The units of information coded as entities, relationships, and operators were reviewed several times for uniqueness since these units of information were used in the data analyses. Values and attributes were not reviewed as many times and should be reviewed prior to future use in further research efforts.

C.1 List of Unique Values

The list of unique values is shown in Table 9.

Table 9. List of Unique Values

LABEL	VALUE DESCRIPTION
V1	1988-1989
V2	operating
V3	100%
V4	50%
V5	environmental considerations
V6	considered permanently shutdown
V7	seven years
V8	serious
V9	true
V10	to rid the DOE of waste, fraud, and abuse
V11	last week
V12	SR
V13	exists
V14	President Bush
V15	Gorbachov
V16	down with problems
V17	normal
V18	inadequate by todays standards
V19	until FMPC is cleaned up
V20	problems with the production complexes
V21	not being able to produce enough material to meet peg points
V22	today
V23	environmental review
V24	nowhere near the estimated time
V25	may never come on-line
V26	shut down
V27	this week
V28	two per week
V29	likely
V30	dont exist
V31	inflated by 25%
V32	By-25%
V33	down-with-problems
V34	catch 22
V35	0
V36	endemic problem
V37	not important
V38	no production
V39	first
V40	second
V41	15 years
V42	not true
V43	inaccurate

Table 9. List of Unique Values (Continued)

LABEL	VALUE DESCRIPTION
V44	.line-item
V45	.not useful
V46	.no new material
V47	.existing material
V48	.start-up is too far off
V49	.one day after DAS/MA gets the new stockpile case
V50	.reduction
V51	.little
V52	.increase
V53	.near-term
V54	.inadequate
V55	.very small
V56	.insignificant
V57	.long-term
V58	.shift in demand
V59	.severe
V60	.particular to that reactor
V61	.tomorrow
V62	.most important
V63	.not ratified by Congress
V64	.reduce demand
V65	.important
V66	.immediately
V67	.no new plutonium
V68	.no reactor targets
V69	.Close FMPC
V70	.minimal
V71	.1989
V72	.clean-up
V73	.no vendors
V74	.for now
V75	.leak stopped
V76	.safe to operate
V77	.ready to operate
V78	.bad
V79	.poor
V80	.defensive
V81	.needs help
V82	.something specific
V83	.now
V84	.proper
V85	.several months
V86	.none

Table 9. List of Unique Values (Continued)

LABEL	VALUE DESCRIPTION
V87	.some time
V88	.in the previous administration
V89	.complete
V90	.as soon as possible
V91	.an unacceptable environmental impact
V92	.two months
V93	.less than two months
V94	.parametric
V95	.two
V96	.properly stored on TRU pads
V97	.not a problem
V98	.significant problem
V99	.limited
V100	.few
V101	.six months
V102	.one year
V103	.curious at best
V104	.realistic
V105	.very excited
V106	.meaningful quantities
V107	.within seven years
V108	.ten or twelve years
V109	.unusual
V110	.many
V111	.less than seven years
V112	.uncertain
V113	.ten years
V114	.useful
V115	.talking stage
V116	.dont spend money on production of nuclear materials unless necessary
V117	.bigger problem
V118	.eminent shut down
V119	.extended
V120	.environmental safety
V121	.mechanical problem
V122	.couple of hours
V123	.not enough time
V124	.unknown
V125	.mechanical shutdown
V126	.scram
V127	.something understood
V128	.fairly paranoid
V129	.quickly

Table 9. List of Unique Values (Continued)

LABEL	VALUE DESCRIPTION
V130	.....adequate
V131	.....not immediately
V132	.....more than seven years
V133	.....replacement of a major piece of equipment
V134	.....five years
V135	.....several
V136	.....two years
V137	.....plutonium
V138	.....tritium
V139	.....six months or more
V140	.....regardless of the outcomes of the incidents
V141	.....nervous
V142	.....not responsible
V143	.....not sufficient
V144	.....bulk
V145	.....Europe
V146	.....several times
V147	.....old
V148	.....undependable
V149	.....available
V150	.....closer to being shut down
V151	.....interested
V152	.....todays standards
V153	.....in process
V154	.....closer to shut down
V155	.....seriously flawed
V156	.....severe enough
V157	.....employeed
V158	.....several years
V159	.....no new tritium
V160	.....through Ohio
V161	.....organizational
V162	.....strategic
V163	.....not severe
V164	.....negative
V165	.....policy decision
V166	.....out of court
V167	.....unhappy with NMP
V168	.....not critical
V169	.....matter of principle
V170	.....difficult
V171	.....long-term problem
V172	.....good enough

Table 9. List of Unique Values (Continued)

LABEL VALUE DESCRIPTION

V173 .....not good enough
V174 .....not ready
V175 .....real
V176 .....reduced numbers
V177 .....forever
V178 .....few days
V179 .....sufficient to investigate the incidents
V180 .....two weeks
V181 .....not so bad
V182 .....structured
V183 .....down the road
V184 .....next week
V185 .....immediate
V186 .....long term
V187 .....much more serious
V188 .....in trouble
V189 .....maybe
V190 .....ironic
V191 .....only reactors available to produce tritium
V192 .....extreme
V193 .....reduced
V194 .....sometime in the future
V195 .....problem
V196 .....last thing that would be of interest
V197 .....exist
V198 .....interesting
V199 .....may never come in
V200 .....unusual occurrence
V201 .....according to plan
V202 .....extremely long time
V203 .....indeterminate
V204 .....appropriate
V205 .....not complete
V206 .....prevent-waste-fraud-and-abuse
V207 .....last nine months
V208 .....very high
V209 .....Begun in 1989
V210 .....very important
V211 .....before 1989
V212 .....comes to pass
V213 .....tactical
V214 .....potential safety venerabilities
V215 .....timely manner

Table 9. List of Unique Values (Continued)

LABEL	VALUE DESCRIPTION
V216	.....confident
V217	.....potential problem in US deterrent
V218	.....desired safety actions not complete
V219	.....significant period of time
V220	.....inactive reserve
V221	.....various
V222	.....certain schedule
V223	.....typically a fair amount ahead of reactor operations
V224	.....generic
V225	.....continues
V226	.....major hazard
V227	.....environmentally acceptable
V228	.....identified
V229	.....an appropriate time
V230	.....never in the past
V231	.....delayed
V232	.....implemented
V233	.....separate
V234	.....permanent
V235	.....fairly high level in DP
V236	.....attention they have needed but not received
V237	.....firm
V238	.....basic issue
V239	.....short-term
V240	.....global
V241	.....half true
V242	.....in the morning newspaper
V243	.....different
V244	.....big problem
V245	.....past
V246	.....no containment domes at SR
V247	.....alleged ES&H violations
V248	.....needed somewhere else
V249	.....many times
V250	.....not the biggest problem
V251	.....right now
V252	.....not a big issue
V253	.....not all that critical
V254	.....not the worlds biggest crisis
V255	.....all the time
V256	.....right
V257	.....not the highest
V258	.....not worried

Table 9. List of Unique Values (Continued)

LABEL	VALUE DESCRIPTION
V259	every day
V260	not surprised
V261	critical
V262	scientific
V263	logical
V264	immediate problem
V265	on-line
V266	typical
V267	does not worry about it
V268	worried about it
V269	enough
V270	may not be enough
V271	long-term solution
V272	great
V273	not an immediate solution
V274	continuing
V275	still
V276	not an immediate crisis

C.2 List of Unique Attributes

The list of unique attributes is shown in Table 10.

Table 10. List of Unique Attributes

LABEL	ATTRIBUTE DESCRIPTION
A1	ALL
A2	role-of
A3	time-period-of
A4	status-of
A5	power-of
A6	reason-for
A7	crossover-for-tritium-of
A8	crossover-for-plutonium-of
A9	nature-of
A10	existence-of
A11	date-of
A12	location-of
A13	parties-in-agreement
A14	files-of
A15	adequacy-of
A16	who-won
A17	rumors-about
A18	number-of
A19	potential-for
A20	margin-of
A21	which
A22	what-type-of-charge-was-current
A23	anticipated-down-time-of
A24	impact-on-production
A25	demand-for-nuclear-materials
A26	what
A27	nature-of-problem
A28	SRs-plans-for-restart
A29	legality-of
A30	problem-solution-for
A31	plan-for-solution-of
A32	plan-for-restart
A33	value-of
A34	level-of
A35	priority-of
A36	who
A37	influence-of
A38	committees-of
A39	plan-for
A40	plan-for-startup
A41	accuracy
A42	funding-status-of
A43	production-of

Table 10. List of Unique Attributes (Continued)

LABEL	ATTRIBUTE DESCRIPTION
A44	.....raw-materials-used-by
A45	.....change-in
A46	.....when
A47	.....support-for-NMP
A48	.....magnitude-of
A49	.....severity-of-problem
A50	.....severity-of
A51	.....anticipated-down-time
A52	.....ability-to-receive-shipments
A53	.....author-of
A54	.....mission-of
A55	.....outcome-of
A56	.....what-material
A57	.....flow-of-material
A58	.....why
A59	.....information-about
A60	.....feelings-of
A61	.....nature-of-reason-for
A62	.....quality-of
A63	.....truth-of
A64	.....stance-of
A65	.....governors-definition-of
A66	.....importance-of
A67	.....reporting-of
A68	.....position-of
A69	.....scope-of
A70	.....quality-of-the-plan-for-startup
A71	.....source-of-funding
A72	.....cost-of
A73	.....level-of-interest
A74	.....demand-for
A75	.....occurence-of
A76	.....attitude-of
A77	.....risk-of
A78	.....age-of
A79	.....reliability-of
A80	.....confidence-in
A81	.....who-reviewed
A82	.....capability-of
A83	.....shipping-of
A84	.....perspective-of
A85	.....need-for
A86	.....perception-of

Table 10. List of Unique Attributes (Continued)

LABEL	ATTRIBUTE DESCRIPTION
A87	.....new-information
A88	.....inventories-of
A89	.....situation-at
A90	.....trend-over-time-of
A91	.....best
A92	.....party-line-of
A93	.....strategy-for
A94	.....problems-of
A95	.....concerns-of
A96	.....probability-of
A97	.....options-for
A98	.....responsibilities-of
A99	.....pressures-of
A100	.....strategy-for-plutonium-production
A101	.....strategy-for-tritium-production
A102	.....amount-of
A103	.....difficulty-of
A104	.....means-of
A105	.....visibility-of
A106	.....performance-of
A107	.....origin-of
A108	.....root-causes-of
A109	.....risk/benefit-of
A110	.....plan for
A111	.....transportation-time-of
A112	.....material-flow-of
A113	.....inventory-of
A114	.....occurrence-of
A115	.....experience-of
A116	.....who-lost
A117	.....staff-of
A118	.....urgency-of
A119	.....facts-about
A120	.....detailed-information-about
A121	.....particular-issues-of
A122	.....budget-waste-in
A123	.....safety-of
A124	.....design-of
A125	.....relevancy-of
A126	.....some-of
A127	.....fears-of
A128	.....problem-of
A129	.....philosophy-of-operations-of

Table 10. List of Unique Attributes (Continued)

LABEL	ATTRIBUTE DESCRIPTION
A130	background-information-of
A131	agenda-of

C.3 List of Unique Entities and Information Characteristics

The list of unique entities and the assigned values for information characteristics are shown in Table 11.

Table 11. List of Unique Entities With Assigned Values for Information Characterisitcs.

LABEL	ENTITY DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	SOURCE
E1	Director of NMP	2	People	Internal	Base
E2	Subject	1	People	External	Base
E3	Exercises	1	Activities	Both	Base
E4	NMP	1	People	Internal	Base
E5	Feed materials production facilities	2	Facilities	Internal	Base
E6	SR Reactors	3	Facilities	Internal	Base
E7	L-reactor	4	Facilities	Internal	Base
E8	K-reactor	4	Facilities	Internal	Base
E9	P-reactor	4	Facilities	Internal	Base
E10	L-reactor power loss	4	Facilities	Internal	Base
E11	C-reactor	4	Facilities	Internal	Base
E12	N-reactor	4	Facilities	Internal	Base
E13	Separations facilities at RL	3	Facilities	Internal	Base
E14	Separations facilities at SR	3	Facilities	Internal	Base
E15	Metal finishing facilities at RL	2	Facilities	Internal	Base
E16	Metal finishing facilities at SR	2	Facilities	Internal	Base
E17	Current stockpile case	2	Products	External	Scenario
E18	President Bush	1	People	External	Scenario
E19	Gorbachov	1	Country	External	Scenario
E20	Arms limitation talks	1	Incidents	External	Scenario
E21	Proposal to cut DOEs current budget by 25%	1	Incidents	External	Scenario
E22	Key members of Congress	1	People	External	Scenario
E23	The Washington Post	3	People	External	Scenario
E24	Article on another incident of contamination at Rocky	1	Incidents	External	Scenario
E25	Deputy Director of NMP	2	People	Internal	Scenario
E26	Reactor was shut down	2	Facilities	Internal	Scenario
E27	Agreement to reduce the number of nuclear weapons	2	Incidents	External	Scenario
E28	FBI	1	People	External	Scenario
E29	RFP	3	Facilities	External	Scenario
E30	Article on an internal DOE contractor memo about sa	1	Incidents	Both	Scenario
E31	Reactor safety analyses	2	Facilities	Internal	Scenario
E32	Governor of Ohio	1	People	External	Scenario
E33	Shipments of nuclear materials through Ohio	2	People	External	Scenario
E34	Leak from one of the tanks at FMPC	3	Facilities	Internal	Scenario
E35	Forrestal	1	Facilities	External	Scenario
E36	Someone	1	People	External	Scenario
E37	Plans for reorganization of DOE	1	Incidents	Both	Scenario
E38	DAS/MA	2	People	External	Scenario
E39	Presidential elections	1	Incidents	External	Scenario
E40	DOE environmental managers	1	People	External	Scenario
E41	All reactors	2	Facilities	Internal	Scenario
E42	Secretary of Energy	1	People	External	Scenario
E43	Some congressmen	1	People	External	Scenario

Table 11. List of Unique Entities With Assigned Values for Information Characterisitcs (Continued)

LABEL	ENTITY DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	SOURCE
E44.	New production reactor capability	1	People	External	Scenario
E45.	HASC	1	People	External	Scenario
E46.	NMPs ability to meet national security requirements	2	Products	Internal	Scenario
E47.	WIPP	3	Facilities	External	Scenario
E48.	Special task force for restarting all the reactors	1	People	External	Scenario
E49.	NMP Division Director	3	People	Internal	Scenario
E50.	Report on major, SIS break-throughs	1	Activities	External	Scenario
E51.	New stockpile cases	2	Products	External	Scenario
E52.	U.S.-Soviet agreements	2	Incidents	External	Scenario
E53.	Signed treaties	2	Incidents	External	Non-Exercise
E54.	NMP activities	1	Activities	Internal	Non-Exercise
E55.	Nuclear material called for in the current President...	2	Products	External	Non-Exercise
E56.	Proposed budget cut	1	Incidents	External	Non-Exercise
E57.	Congressional hearings	2	People	External	Non-Exercise
E58.	Staff	2	People	Internal	Non-Exercise
E59.	Testimony on budget cuts	1	Activities	Internal	Non-Exercise
E61.	Amount of money to run NMP facilities	2	Resources	Internal	Non-Exercise
E62.	Questions from the general public	1	People	External	Non-Exercise
E63.	Congress	1	People	External	Non-Exercise
E64.	Congressional Committees	2	People	External	Non-Exercise
E65.	NMPs new ability to produce material	2	Products	Internal	Non-Exercise
E66.	Presidential Stockpile Memorandum	2	People	External	Non-Exercise
E67.	OWP	2	People	External	Non-Exercise
E68.	Weapons cut	2	Incidents	External	Non-Exercise
E69.	Contamination at RFP	3	Facilities	External	Non-Exercise
E70.	Safety and Security staff	1	People	External	Non-Exercise
E71.	Questions about safety analyses	2	Facilities	Internal	Non-Exercise
E72.	Superiors	1	People	External	Non-Exercise
E73.	Briefings on safety analyses	1	Incidents	Both	Non-Exercise
E74.	Chief Council	1	People	External	Non-Exercise
E75.	AS/DP	1	People	External	Non-Exercise
E76.	Shipments needed from FMPC	3	Facilities	Internal	Non-Exercise
E77.	Endemic problems	1	Incidents	Both	Non-Exercise
E78.	Single-type machines	2	Facilities	Internal	Non-Exercise
E79.	SR	1	Sites	Internal	Non-Exercise
E80.	Resources	1	Resources	Internal	Non-Exercise
E81.	Tritium recycle	4	Products	Internal	Non-Exercise
E82.	Pantex	2	Facilities	External	Non-Exercise
E83.	Supply of nuclear material	2	Products	Internal	Non-Exercise
E84.	Demand for nuclear material	2	Products	External	Non-Exercise
E85.	OR	1	Sites	External	Non-Exercise
E86.	facts	1	Information	External	Non-Exercise
E87.	Something	1	Activities	Both	Non-Exercise

Table 11. List of Unique Entities With Assigned Values for Information Characterisitcs (Continued)

LABEL	ENTITY DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	SOURCE
E88.	Someone other than the Director of NMP	1	People	Internal	Non-Exercise
E89.	NMP decision	1	Decisions	Both	Non-Exercise
E90.	Information provided	1	People	External	Non-Exercise
E91.	Agreement with decisions	1	Activities	Both	Non-Exercise
E92.	Environmental review	1	Incidents	Both	Non-Exercise
E93.	Authorization and appropriation committees	3	People	External	Non-Exercise
E94.	Defense for HASC meeting	1	People	External	Non-Exercise
E95.	Secretarys agreement	1	People	External	Non-Exercise
E96.	Alternative storage locations to WIPP	3	Facilities	External	Non-Exercise
E97.	Rumors of WIPP failure to startup	3	Facilities	External	Non-Exercise
E98.	SIS	1	Activities	External	Non-Exercise
E100.	Vunerabilities	1	Facilities	Internal	Non-Exercise
E101.	DOEs current budget	2	Resources	External	Non-Exercise
E102.	NMPs current budget	2	Resources	Internal	Non-Exercise
E103.	NMP budget	2	Resources	Internal	Non-Exercise
E104.	Incidents reported in newspapers	2	People	External	Non-Exercise
E105.	Bigger problem at RFP	3	Facilities	External	Non-Exercise
E106.	NMP facilities	1	Facilities	Internal	Non-Exercise
E107.	Incidents in the scenario	1	Incidents	Both	Non-Exercise
E108.	Alternative supplies of nuclear material	2	Products	Internal	Non-Exercise
E109.	Alternative supplies of plutonium	3	Products	Internal	Non-Exercise
E110.	Accelerated plutonium scrap processing	4	Products	Internal	Non-Exercise
E111.	Alternative supplies of tritium	3	Products	Internal	Non-Exercise
E112.	Reactor production of tritium	4	Products	Internal	Non-Exercise
E113.	Tritium recycle from retired weapons	4	Products	Internal	Non-Exercise
E114.	DAS/MA Staff	2	People	External	Non-Exercise
E115.	Planning Division Director	3	People	Internal	Non-Exercise
E116.	New supply/demand cases	2	Products	External	Non-Exercise
E117.	Current supply/demand cases	2	Products	External	Non-Exercise
E118.	Mix of nuclear material required	2	Products	External	Non-Exercise
E119.	Plutonium	2	Products	External	Non-Exercise
E120.	Tritium	2	Products	External	Non-Exercise
E121.	LLCs	2	Products	External	Non-Exercise
E122.	Reactor Division Director	3	People	Internal	Non-Exercise
E123.	Internal DOE contractor memo about safety analyses	2	Facilities	Internal	Non-Exercise
E124.	Other DOE organizations	1	People	External	Non-Exercise
E125.	LLNL	1	Sites	External	Non-Exercise
E126.	FMPC	3	Facilities	Internal	Non-Exercise
E127.	Governor of Ohios actions	2	People	External	Non-Exercise
E128.	Weapons complex	1	Facilities	External	Non-Exercise
E129.	Depleted uranium	3	Products	External	Non-Exercise
E130.	DOE	1	People	External	Non-Exercise
E131.	Commercial vendors	5	Products	Internal	Non-Exercise

Table 11. List of Unique Entities With Assigned Values for Information Characterisitcs (Continued)

LABEL	ENTITY DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	SOURCE
E132.	Y-12	2	Facilities	External	Non-Exercise
E133.	Sole supplier of depleted uranium	4	Products	Internal	Non-Exercise
E134.	Problem	1	Incidents	Both	Non-Exercise
E135.	FMPC workers	3	Facilities	Internal	Non-Exercise
E136.	Environment	1	Environment	Both	Non-Exercise
E137.	Everyone	1	People	External	Non-Exercise
E138.	Answers to questions about the reactors	2	Facilities	Internal	Non-Exercise
E139.	Conduct of operations of the reactors	2	Facilities	Internal	Non-Exercise
E140.	Plan for restarting the reactors	2	Facilities	Internal	Non-Exercise
E141.	Someone other than staff	2	People	Internal	Non-Exercise
E142.	Rumors	1	Activities	Both	Non-Exercise
E143.	DAS/MA statements	2	People	External	Non-Exercise
E144.	Meeting	1	Activities	Both	Non-Exercise
E145.	Additional activities	1	Activities	Internal	Non-Exercise
E146.	Cleaned-up	2	People	External	Non-Exercise
E147.	A specific FMPC clean-up task	1	People	External	Non-Exercise
E148.	NMP capabilities	1	People	Internal	Non-Exercise
E149.	Other problems	1	Incidents	Both	Non-Exercise
E150.	Republican Party	1	People	External	Non-Exercise
E151.	Executive Branch	1	People	External	Non-Exercise
E152.	Administrative policies	2	People	External	Non-Exercise
E153.	Current NMP initiatives	1	Activities	Internal	Non-Exercise
E154.	Vice-President	1	People	External	Non-Exercise
E155.	Crossover point of all material	2	Products	External	Non-Exercise
E156.	A specific reactor environmental task	1	Incidents	Both	Non-Exercise
E157.	Bigger problem	1	Incidents	Both	Non-Exercise
E158.	Replacement for NMP reactors	2	Facilities	Internal	Non-Exercise
E159.	Environmental concerns	1	Environment	Both	Non-Exercise
E160.	Recommendations from the environmental review	2	Incidents	Both	Non-Exercise
E161.	Alternatives to WIPP	3	Facilities	External	Non-Exercise
E162.	TRU waste	3	Products	External	Non-Exercise
E163.	TRU waste at SR	4	Products	External	Non-Exercise
E164.	TRU waste at RFP	4	Products	External	Non-Exercise
E165.	EM	1	People	External	Non-Exercise
E166.	Time to bring a major project on-line	1	People	External	Non-Exercise
E167.	Plutonium problem	3	Products	Internal	Non-Exercise
E168.	Another DP office	1	People	External	Non-Exercise
E169.	Crossover point for plutonium	3	Products	External	Non-Exercise
E170.	Tritium production	3	Products	Internal	Non-Exercise
E171.	Latest NMP tools	2	Products	External	Non-Exercise
E172.	Decision-maker	1	People	External	Non-Exercise
E173.	Reactor	2	Facilities	Internal	Non-Exercise
E174.	Public	1	People	External	Non-Exercise

Table 11. List of Unique Entities With Assigned Values for Information Characterisitcs (Continued)

LABEL	ENTITY DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	SOURCE
E175.	Plan for dealing with the media	1	People	External	Non-Exercise
E176.	Press announcement	1	People	External	Non-Exercise
E177.	DOD	1	People	External	Non-Exercise
E178.	OMB	2	People	External	Non-Exercise
E179.	Oversight groups	1	People	External	Non-Exercise
E180.	New supply/demand assumptions	2	Products	External	Non-Exercise
E181.	Upgrades	1	Activities	Internal	Non-Exercise
E182.	Strategic plan	1	Activities	Both	Non-Exercise
E183.	All sites	2	People	External	Non-Exercise
E184.	RL	1	Sites	Internal	Non-Exercise
E185.	Options for dealing with incidents	2	Incidents	Both	Non-Exercise
E186.	Incidents	1	Incidents	Both	Non-Exercise
E187.	Other incidents	1	Incidents	Both	Non-Exercise
E188.	Accelerated returns from the stockpile	3	Products	External	Non-Exercise
E189.	Other NMP activities	1	Activities	Internal	Non-Exercise
E190.	Nuclear weapons	2	Products	External	Non-Exercise
E191.	Other reactors	2	Facilities	Internal	Non-Exercise
E192.	Other facilities	1	Facilities	Internal	Non-Exercise
E193.	Safety analyses of other facilities	1	Facilities	Internal	Non-Exercise
E194.	Experts	1	People	External	Non-Exercise
E195.	Facility	1	Facilities	External	Non-Exercise
E196.	Questions about the facility	1	Facilities	External	Non-Exercise
E197.	SAIC	2	People	Internal	Non-Exercise
E198.	Support contractors	2	People	Internal	Non-Exercise
E199.	EH	1	People	External	Non-Exercise
E200.	People who know the information	1	People	External	Non-Exercise
E201.	Major upgrade program	1	Activities	Internal	Non-Exercise
E202.	Nuclear material	1	Products	External	Non-Exercise
E203.	Nuclear material at FMPC	3	Facilities	Internal	Non-Exercise
E204.	Decision	1	Decisions	Both	Non-Exercise
E205.	Plan for options for dealing with incidents	2	Incidents	Both	Non-Exercise
E206.	Problems at FMPC	3	Facilities	Internal	Non-Exercise
E207.	Governor of Colorado	1	People	External	Non-Exercise
E208.	General Council	1	People	External	Non-Exercise
E209.	Court	1	People	External	Non-Exercise
E210.	Inventories of depleted uranium	4	Products	External	Non-Exercise
E212.	National security requirements	2	People	External	Non-Exercise
E213.	DOEs ability to meet the current stockpile case	2	Products	External	Non-Exercise
E214.	HASC hearings	1	People	External	Non-Exercise
E215.	Final recommendation	1	Decisions	Both	Non-Exercise
E216.	Reporters	1	People	External	Non-Exercise
E217.	Plutonium waste	3	Products	External	Non-Exercise
E218.	Reactor production of plutonium	4	Products	Internal	Non-Exercise

Table 11. List of Unique Entities With Assigned Values for Information Characterisitcs (Continued)

LABEL	ENTITY DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	SOURCE
E219.	Scrap recovery	4	Products	Internal	Non-Exercise
E220.	Reactor outage	2	Facilities	Internal	Non-Exercise
E221.	Corrective actions	1	Activities	Both	Non-Exercise
E222.	Supply of plutonium	3	Products	Internal	Non-Exercise
E223.	Supply of tritium	3	Products	Internal	Non-Exercise
E224.	OMA	1	People	External	Non-Exercise
E226.	Congressional staff	1	People	External	Non-Exercise
E227.	NMP programs	1	Activities	Internal	Non-Exercise
E228.	NMP budget controls	2	Resources	Internal	Non-Exercise
E229.	DP-50	1	People	External	Non-Exercise
E230.	DOE Congressional Affairs	1	People	External	Non-Exercise
E231.	Educational process for congressional staff	1	People	External	Non-Exercise
E232.	Congressmen in affected regions	2	People	External	Non-Exercise
E233.	Affected regions	2	People	External	Non-Exercise
E234.	Contamination at NMP facilities	1	Facilities	Internal	Non-Exercise
E235.	DOE activities	1	People	External	Non-Exercise
E236.	Conduct of operations	2	Facilities	Internal	Non-Exercise
E237.	Media	1	People	External	Non-Exercise
E239.	Venerabilities	1	Facilities	Internal	Non-Exercise
E240.	Weapons returns	3	Products	External	Non-Exercise
E241.	Actions	1	Activities	Both	Non-Exercise
E242.	Plutonium targets	3	Products	External	Non-Exercise
E243.	Processing of retired weapons	3	Products	External	Non-Exercise
E244.	Corrective actions at FMPC	3	Facilities	Internal	Non-Exercise
E245.	Governor of Ohios concerns	1	People	External	Non-Exercise
E246.	Ohio officials	1	People	External	Non-Exercise
E247.	Tanks at FMPC	3	Facilities	Internal	Non-Exercise
E248.	People	1	People	External	Non-Exercise
E249.	Person trying to do his job	1	People	External	Non-Exercise
E250.	Major administrative policies	2	People	External	Non-Exercise
E251.	Other NMP facilities	1	Facilities	Internal	Non-Exercise
E252.	Environmental issues	1	Environment	Both	Non-Exercise
E253.	All problems	1	Incidents	Both	Non-Exercise
E254.	United States	1	Country	Both	Non-Exercise
E256.	OMA activities	1	People	External	Non-Exercise
E257.	Reactor organization	3	People	Internal	Non-Exercise
E258.	Blending of plutonium at SR	4	Products	Internal	Non-Exercise
E259.	Fact sheet	2	Facilities	Internal	Non-Exercise
E260.	Statements	1	Decisions	Both	Non-Exercise
E261.	One site	2	People	External	Non-Exercise
E262.	Other sites	2	People	External	Non-Exercise
E263.	Articles	2	People	External	Non-Exercise
E264.	DOE problems	1	People	External	Non-Exercise

Table 11. List of Unique Entities With Assigned Values for Information Characterisitcs (Continued)

LABEL	ENTITY DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	SOURCE
E265.	Plant Manager at SR	1	Sites	Internal	Non-Exercise
E266.	Safety problem	2	Facilities	Internal	Non-Exercise
E267.	Demand for plutonium	3	Products	External	Non-Exercise
E268.	Testimony for HASC	1	Activities	Internal	Non-Exercise
E269.	Secretary of Energys statements	1	People	External	Non-Exercise
E270.	HASC letter of invitation	1	People	External	Non-Exercise
E271.	Congressmen	1	People	External	Non-Exercise
E272.	Ronald Reagan	1	People	External	Non-Exercise
E273.	TRU waste storage space	1	Facilities	Internal	Non-Exercise
E274.	OMA facilities	1	Facilities	External	Non-Exercise
E275.	Separations facilities	2	Facilities	Internal	Non-Exercise

C.4 List of Unique Relationships and Information Characterisitcs

The list of unique relationships and the assigned values for information characteristics are shown in Table 12.

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R1. . .	EQUALS |A2(E2), (E1)|	2. . .	Assignment	Both	1
R2. . .	EQUALS |A3(E3), V1|	1. . .	Assignment	Both	1
R3. . .	OWNS |(E4), (E5)|	2. . .	Ownership	Internal	1
R4. . .	OWNS |(E4), (E6)|	3. . .	Ownership	Internal	1
R5. . .	EQUALS |A4(E6), V2|	3. . .	Assignment	Internal	1
R6. . .	EQUALS |A4(E7), V2|	4. . .	Assignment	Internal	1
R7. . .	EQUALS |A4(E8), V2|	4. . .	Assignment	Internal	1
R8. . .	EQUALS |A4(E9), V2|	4. . .	Assignment	Internal	1
R9. . .	EQUALS |A5(E8), V3|	4. . .	Assignment	Internal	1
R10. .	EQUALS |A5(E9), V3|	4. . .	Assignment	Internal	1
R11. .	EQUALS |A5(E7), V4|	4. . .	Assignment	Internal	1
R12. .	EQUALS |A6(E10), V5|	4. . .	Assignment	Internal	1
R13. .	EQUALS |A4(E11), V6|	4. . .	Assignment	Internal	1
R14. .	EQUALS |A4(E12), V6|	4. . .	Assignment	Internal	1
R15. .	OWNS |(E4), (E13)|	3. . .	Ownership	Internal	1
R16. .	OWNS |(E4), (E14)|	3. . .	Ownership	Internal	1
R17. .	EQUALS |A4(E13), V2|	3. . .	Assignment	Internal	1
R18. .	EQUALS |A4(E14), V2|	3. . .	Assignment	Internal	1
R19. .	OWNS |(E4), (E15)|	2. . .	Ownership	Internal	1
R20. .	OWNS |(E4), (E16)|	2. . .	Ownership	Internal	1
R21. .	EQUALS |A4(E15), V2|	2. . .	Assignment	Internal	1
R22. .	EQUALS |A4(E16), V2|	2. . .	Assignment	Internal	1
R23. .	EQUALS |A7(E17), V7|	2. . .	Assignment	External . . .	1
R24. .	EQUALS |A8(E17), V7|	2. . .	Assignment	External . . .	1
R25. .	EQUALS |A9,OP1, V8|	1. . .	Assignment	External . . .	2
R26. .	EQUALS |A10(E21), V9|	1. . .	Assignment	External . . .	1
R27. .	EQUALS |A6,OP2, V10|	1. . .	Assignment	External . . .	2
R28. .	EQUALS |A11(E24), V11|	1. . .	Assignment	External . . .	1
R29. .	EQUALS |A12(E26), V12|	2. . .	Assignment	Internal	1
R30. .	EQUALS |A10(E27), V13|	2. . .	Assignment	External . . .	1
R31. .	EQUALS |A13(E27), V14, AND V15|	2. . .	Assignment	External . . .	1
R32. .	EQUALS |A11,OP5, V11|	3. . .	Assignment	External . . .	2
R33. .	EQUALS |A11,OP6, V11|	3. . .	Assignment	External . . .	2
R34. .	EQUALS |A4(E8), V16|	4. . .	Assignment	Internal	1
R35. .	EQUALS |A4(E9), V17|	4. . .	Assignment	Internal	1
R36. .	EQUALS |A4(E7), V17|	4. . .	Assignment	Internal	1
R37. .	EQUALS |A15(E31), V18|	2. . .	Assignment	Internal	1
R38. .	CONTAINS |(E30), R37|	2. . .	Ownership	External . . .	2
R39. .	EQUALS |A3,OP8, V19|	2. . .	Assignment	External . . .	2
R40. .	EQUALS |A10(E34), V13|	3. . .	Assignment	Internal	1
R41. .	EQUALS |A11(E34), V11|	3. . .	Assignment	Internal	1
R42. .	EQUALS |A6(E37), V20|	1. . .	Assignment	Both	1
R43. .	EQUALS |A6,OP11, V21|	2. . .	Assignment	Both	2

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R44. .	EQUALS |A11,OP11, V22|	2	Assignment	Both	2
R45. .	EQUALS |A16(E39), (E18)|	1	Assignment	External	1
R46. .	EQUALS |A16,OP12, (E40)|	2	Assignment	Both	2
R47. .	EQUALS |A6,OP13, V23|	2	Assignment	Both	2
R48. .	EQUALS |A4(E47), V24|	3	Assignment	External	1
R49. .	EQUALS |A17(E47), V25|	3	Assignment	External	1
R50. .	EQUALS |A4(E41), V26|	2	Assignment	Internal	1
R51. .	EQUALS |A11,OP13, V27|	2	Assignment	Both	2
R52. .	EQUALS |A18(E51), V28|	2	Assignment	External	1
R53. .	EQUALS |A19(E52), V29|	2	Assignment	External	1
R54. .	EQUALS |A6(E51), OP20|	2	Assignment	External	3
R55. .	EQUALS |(E53), V30|	2	Assignment	External	1
R56. .	PROVIDES |(E1), (E55)|	2	Order	Both	1
R57. .	EQUALS |(E57), V9|	2	Assignment	External	1
R58. .	EQUALS |(E56), V9|	1	Assignment	External	1
R59. .	IFTHEN |R58, R57|	2	Assignment	External	3
R60. .	EQUALS |(E102), (E61)|	2	Assignment	Internal	1
R61. .	INCLUDES |(E59), R60|	2	Ownership	Internal	2
R62. .	ISNOTEQUAL |A20(E102), V31|	2	Assignment	Internal	1
R63. .	LESSTHAN |(E56), (E102), V32|	2	Assignment	Both	1
R64. .	WHATIS |(E65), A25(E66)|	2	Assignment	Both	1
R65. .	IMPACT |(E68), (E54)|	2	Impact	Both	1
R66. .	KNOWING |R65|	2	Ownership	Both	2
R67. .	IMPORTANT |R66|	2	Assignment	Both	3
R68. .	OWNS |(E38), (E29)|	3	Ownership	External	1
R69. .	WHATIMPACT |(E69), (E54)|	3	Impact	Both	1
R70. .	EQUALS |A4(E8), V33|	4	Assignment	Internal	1
R71. .	EQUALS |A9,OP8, V34|	2	Assignment	External	2
R72. .	EQUALS |A4(E6), V26|	3	Assignment	Internal	1
R73. .	EQUALS |A18(E76), V35|	3	Assignment	Internal	1
R74. .	IFTHEN |R72, R73|	3	Assignment	Internal	3
R75. .	EQUALS |A6,R72, V36|	3	Assignment	Internal	2
R76. .	EQUALS |A4(E6), V6|	3	Assignment	Internal	1
R77. .	IFTHEN |R75, R76|	3	Assignment	Internal	4
R78. .	OFCONCERN |(E77), (E78)|	2	Assignment	External	1
R79. .	EQUALS |A33(E37), V37|	1	Assignment	Both	1
R80. .	EQUALS |A34(E38), A34(E1)|	2	Assignment	Both	1
R81. .	IFTHEN:NOEFFECT |R80, OP11, (E54)|	2	Impact	Both	3
R82. .	EQUALS |A4(E82), V38|	2	Assignment	External	1
R83. .	EQUALS |A4(E29), V26|	3	Assignment	External	1
R84. .	IFTHEN |R83, R82|	3	Assignment	External	3
R85. .	EQUALS |(E83), (E84)|	2	Assignment	Both	1
R86. .	IFTHEN |R83, R85|	3	Assignment	Both	3

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R87.	EQUALS |A35,OP61, V39|	3	Assignment	Internal	2
R88.	EQUALS |A35,OP70, V40|	3	Assignment	Both	2
R89.	WHATIMPACT |(E39), (E84)|	2	Impact	External	1
R90.	DEPENDSON |(E90), AND (E91), OP77|	2	Order	External	2
R91.	EQUALS |A10(E44), V13|	1	Assignment	External	1
R92.	EQUALS |A10(E95), V13|	1	Assignment	External	1
R93.	IMPACT |R48, (E54)|	3	Impact	Both	2
R94.	EQUALS |A3(E97), V41|	3	Assignment	External	1
R95.	EQUALS |A33(E97), V37|	3	Assignment	External	1
R96.	EQUALS |A4,OP77, V42|	2	Assignment	Internal	2
R97.	EQUALS |A41(E50), V43|	1	Assignment	External	1
R98.	NOIMPACT |(E50), (E54)|	1	Impact	Both	1
R99.	EQUALS |A42(E98), V44|	1	Assignment	External	1
R100.	NOTEQUALS |A42(E98), V44|	1	Assignment	External	1
R101.	EQUALS |A33(E98), V45|	1	Assignment	External	1
R102.	EQUALS |A43(E98), V46|	1	Assignment	External	1
R103.	EQUALS |A44(E98), V47|	1	Assignment	External	1
R104.	NOIMPACT |(E98), (E54)|	1	Impact	Both	1
R105.	EQUALS |A6,R104, V48|	1	Assignment	Both	2
R106.	EQUALS |A4(E41), V6|	2	Assignment	Internal	1
R107.	EQUALS |A33(E98), V35|	1	Assignment	External	1
R108.	IFTHEN |R106, R107|	2	Assignment	Both	3
R109.	EQUALS |A33(E50), V37|	1	Assignment	External	1
R110.	EQUALS |A11,OP104, V49|	2	Assignment	Both	2
R111.	IMPACTOF |(E51), (E84)|	2	Impact	External	1
R112.	EQUALS |A10(E100), V13|	1	Assignment	Internal	1
R113.	IMPLIES |A4(E106), R112|	1	Implication	Internal	2
R114.	IMPACT |(E100), (E46)|	2	Impact	Internal	1
R115.	DOESNOTINCLUDE |A4(E106), (E52)|	2	Ownership	Both	1
R116.	EQUALS |A45(E17), V29|	2	Assignment	External	1
R117.	INCLUDE |(E51), A1(E20)|	2	Ownership	External	1
R118.	IMPACT |(E20), (E84)|	2	Impact	External	1
R119.	EQUALS |R118, V50|	2	Assignment	External	2
R120.	WHATIS |(E51), (E65)|	2	Assignment	Both	1
R121.	IMPLIES |(E20), OP109|	2	Implication	External	2
R122.	DOESNOTEQUAL |A6,OP109, V10|	2	Assignment	External	2
R123.	EQUALS |A47(E36), V51|	1	Assignment	External	1
R124.	EQUALS |A3,R123, V1|	1	Assignment	External	2
R125.	EQUALS |A45(E84), V52|	2	Assignment	External	1
R126.	EQUALS |A3,OP109, A3,R125|	2	Assignment	External	3
R127.	IMPACT |OP2, (E102)|	2	Impact	Both	2
R128.	NOIMPACT |OP2, (E54)|	1	Impact	Both	2
R129.	EQUALS |A3,R128, V53|	1	Assignment	Both	3

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R130.	EQUALS |A15(E83), V54|	2	Assignment	Internal	1
R131.	EQUALS |A15(E103), V54|	2	Assignment	Internal	1
R132.	IMPLIES |R131, R130|	2	Implication	Internal	3
R133.	EQUALS |A35,OP2, V39|	1	Assignment	External	2
R134.	NOIMPACT |(E24), (E54)|	1	Impact	Both	1
R135.	EQUALS |A48(E104), V55, AND V56|	2	Assignment	External	1
R136.	NOIMPACT |(E104), (E54)|	2	Impact	Both	1
R137.	IMPLIES |A27(E69), (E105)|	3	Implication	External	1
R138.	IMPACT |(E69), (E84)|	3	Impact	External	1
R139.	EQUALS |A3,R138, V53|	3	Assignment	External	2
R140.	EQUALS |A3,R138, V57|	3	Assignment	External	2
R141.	NOIMPACT |(E69), (E84)|	3	Impact	External	1
R142.	EQUALS |A3,R141, V57|	3	Assignment	External	2
R143.	EQUALS |A48,R138, V58|	3	Assignment	External	2
R144.	IMPACT |(E69), (E83)|	3	Impact	Both	1
R145.	EQUALS |A50(E26), V59|	2	Assignment	Internal	1
R146.	IMPLIES |R23, AND R24, R145|	2	Implication	Both	4
R147.	EQUALS |A27(E26), V60|	2	Assignment	Internal	1
R148.	IMPACT |(E26), (E41)|	2	Impact	Internal	1
R149.	EQUALS |A10(E52), V30|	2	Assignment	External	1
R150.	EQUALS |A11,OP125, V61|	1	Assignment	External	2
R151.	IMPLIES |R150, R149|	2	Implication	External	4
R152.	IMPLIES |R150, R125|	2	Implication	External	4
R153.	EQUALS |A45(E54), V29|	1	Assignment	Internal	1
R154.	IMPLIES |(E107), R153|	1	Implication	External	2
R155.	EQUALS |A50(E26), V62|	2	Assignment	Internal	1
R156.	IMPLIES |(E26), A45(E54)|	2	Implication	Internal	1
R157.	IMPLIES |A4(E106), OP130|	2	Implication	Internal	3
R158.	INCLUDE |(E109), (E110)|	4	Ownership	Internal	1
R159.	INCLUDEOTHERTHAN |(E109), (E110)|	4	Ownership	Internal	1
R160.	EASIERTHAN |OP132, OP131|	3	Assignment	Both	3
R161.	EQUALS |(E111), (E112), AND (E113)|	4	Assignment	Internal	1
R162.	IMPACT |(E52), (E54)|	2	Impact	Both	1
R163.	INCLUDES |(E116), (E52)|	2	Ownership	External	1
R164.	IMPACT |(E52), (E117)|	2	Impact	External	1
R165.	EQUALS |A4(E52), V63|	2	Assignment	External	1
R166.	IMPACT |(E52), (E84)|	2	Impact	External	1
R167.	EQUALS |R166, V64|	2	Assignment	External	2
R168.	IMPLIES |(E68), A45(E118)|	2	Implication	External	1
R169.	EQUALS |A27(E29), V59|	3	Assignment	External	1
R170.	IMPLIES |OP5, AND OP6, R169|	3	Implication	External	4
R171.	DOESNOTOWN |(E4), (E29)|	3	Ownership	Both	1
R172.	IMPACT |A27(E29), A43(E29)|	3	Impact	External	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R173.	IMPACT |A27(E29), A52(E29)|	3	Impact	External	1
R174.	IMPACT |A27(E29), (E84)|	3	Impact	External	1
R175.	IMPACT |A27(E29), (E54)|	3	Impact	Both	1
R176.	IMPLIES |A27(E29), OP151|	3	Implication	Both	2
R177.	IMPLIES |A27(E29), OP152|	3	Implication	Both	2
R178.	EQUALS |A30,R34, V13|	4	Assignment	Internal	2
R179.	IMPACT |R34, (E54)|	4	Impact	Internal	2
R180.	IMPACT |R34, (E83)|	4	Impact	Internal	2
R181.	EQUALS |A33,OP161, V65|	4	Assignment	Both	4
R182.	EQUALS |A43(E106), OP162|	4	Assignment	Internal	2
R183.	EQUALS |A11,OP163, V66|	2	Assignment	External	2
R184.	EQUALS |A43(E106), V67|	1	Assignment	Internal	1
R185.	EQUALS |A43(E126), V68|	3	Assignment	Internal	1
R186.	IMPACTS |R184, R185|	3	Impact	Internal	3
R187.	IMPACT |(E127), OP174|	3	Impact	Both	3
R188.	IMPACT |(E127), OP177|	3	Impact	Both	3
R189.	IMPACT |(E127), OP180|	3	Impact	Both	3
R190.	EQUALS |A6,OP182, V69|	5	Assignment	Both	3
R191.	EQUALS |A6, OP183, R185|	3	Assignment	Both	4
R192.	EQUALS |A3,R185, V71|	3	Assignment	Internal	2
R193.	WILLEQUAL |A54(E126), V38|	3	Assignment	Internal	1
R194.	WILLEQUAL |A54(E126), V72|	3	Assignment	Internal	1
R195.	EQUALS |A6, OP183,R193|	3	Assignment	Both	4
R196.	IFTHEN |R198, R197|	5	Assignment	Both	5
R197.	EQUALS |(E126), (E133)|	4	Assignment	Internal	1
R198.	EQUALS |A55, OP182, V73|	5	Assignment	Both	3
R199.	EQUALS |A3, OP183, V74|	2	Assignment	Both	3
R200.	EQUALS |(E34), (E134)|	3	Assignment	External	1
R201.	RELATIONSHIPOF |(E130), (E32)|	1	Order	External	1
R202.	NEGATIVEIMPACT |(E34), R201|	3	Impact	Both	2
R203.	POTENTIALNEGATIVEIMPACT |(E34), (E135)|	3	Impact	Internal	1
R204.	POTENTIALNEGATIVEIMPACT |(E34), (E136)|	3	Impact	External	1
R205.	EQUALS |A4(E34), V75|	3	Assignment	Internal	1
R206.	EQUALS |A50(E34), V59|	3	Assignment	Internal	1
R207.	EQUALS |A50,R50, V8|	2	Assignment	Internal	2
R208.	EQUALS |A4(E41), V76|	2	Assignment	Internal	1
R209.	EQUALS |A4(E41), V77|	2	Assignment	Internal	1
R210.	OWN |(E1), (E140)|	2	Ownership	Internal	1
R211.	EQUALS |A35,OP200, V39|	2	Assignment	Internal	2
R212.	EQUALS |A60(E1), V78|	2	Assignment	Internal	1
R213.	EQUALS |A6(E37), (E1)|	2	Assignment	External	1
R214.	IFTHEN |R213, R212|	2	Assignment	Both	3
R215.	EQUALS |(E142), (E142)|	1	Assignment	Both	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R216.	EQUALS |A62,OP206, V79|	2	Assignment	External	2
R217.	EQUALS |A63(E143), V9|	2	Assignment	External	1
R218.	EQUALS |A63(E143), V42|	2	Assignment	External	1
R219.	DEPENDSON |A63(E143), A9(E144)|	2	Order	Both	1
R220.	EQUALS |A64(E1), V80|	2	Assignment	Internal	1
R221.	EQUALS |A4(E1), V81|	2	Assignment	Internal	1
R222.	DEPENDINGON |OP209, OP210|	2	Order	Both	3
R223.	IMPACT |OP8, (E54)|	2	Impact	Both	2
R224.	NOIMPACT |OP8, (E54)|	2	Impact	Both	2
R225.	EQUALS |A65(E146), V82|	2	Assignment	External	1
R226.	EQUALS |A65(E146), (E147)|	2	Assignment	External	1
R227.	INCLUDES |(E148), (E147)|	1	Ownership	Both	1
R228.	IFTHEN |R41, AND R230, R229|	3	Assignment	Both	5
R229.	EQUALS |A10(E149), V13|	1	Assignment	Both	1
R230.	EQUAL |A11,OP221, V83|	3	Assignment	Both	2
R231.	EQUALS |A67(E34), V84|	3	Assignment	Internal	1
R232.	CONTROLS |(E150), (E151)|	1	Ownership	External	1
R233.	EQUALS |A3,OP228, V85|	2	Assignment	Both	3
R234.	EQUALS |A45(E152), V86|	2	Assignment	External	1
R235.	EQUALS |A3,OP229, V87|	1	Assignment	Both	2
R236.	EQUALS |A68(E18), (E154)|	1	Assignment	External	1
R237.	EQUALS |A3,R236, V88|	1	Assignment	External	2
R238.	EQUALS |A11(E155), V7|	2	Assignment	External	1
R239.	IMPACT |OP13, R238|	2	Impact	Both	3
R240.	EQUALS |A50,R239, V59|	2	Assignment	Both	4
R241.	EQUALS |A4(E41), V2|	2	Assignment	Internal	1
R242.	WITH |R241, R238|	2	Order	Both	3
R243.	IMPACT |R50, R238|	2	Impact	Both	3
R244.	EQUALS |A50,R243, V59|	2	Assignment	Both	4
R245.	EQUALS |A6,OP230, OP231|	2	Assignment	Both	6
R246.	EQUALS |A4(E156), V89|	1	Assignment	Both	1
R247.	BIGGERTHAN |A9(E92), (E156)|	1	Assignment	Both	1
R248.	EQUALS |A10(E157), V13|	1	Assignment	Both	1
R249.	IFTHEN |R247, R248|	1	Assignment	Both	3
R250.	DOESNOTOWN |(E4), (E44)|	1	Ownership	Both	1
R251.	EQUALS |A3,R250, V1|	1	Assignment	Both	2
R252.	EQUALS |(E44), (E158)|	2	Assignment	Both	1
R253.	EQUALS |A11,R241, V90|	2	Assignment	Internal	2
R254.	IMPACT |(E92), (E54)|	1	Impact	External	1
R255.	INCLUDES |(E116), R254, AND (E17)|	2	Ownership	External	2
R256.	INCLUDES |(E116), R254, AND A32(E41)|	2	Ownership	Both	2
R257.	INDEPENDENT |A32(E7), A32(E8), A32(E9)|	4	Order	Internal	1
R258.	DEPENDSON |A32(E7), A32(E8), A32(E9)|	4	Order	Internal	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R259.	EQUALS |A3(E92), A3,R241|	2	Assignment	External	2
R260.	EQUALS |A6,OP13, V91|	2	Assignment	Both	2
R261.	EQUALS |A3(E92), V92|	1	Assignment	Both	1
R262.	EQUALS |A3(E92), V93|	1	Assignment	Both	1
R263.	BEFORE |OP254, OP255|	2	Order	External	3
R264.	BEFORE |OP257, OP258|	2	Order	External	3
R265.	EQUALS |A11,OP258, V61|	2	Assignment	Both	2
R266.	IMPACT |(E92), (E83)|	2	Impact	External	1
R267.	EQUALS |A9,OP262, V94|	3	Assignment	Both	3
R268.	EQUALS |A18,OP263, V95|	2	Assignment	Internal	2
R269.	IFTHEN |R257, R268|	4	Assignment	Internal	4
R270.	EQUALS |A50,R93, V59|	3	Assignment	Both	3
R271.	EQUALS |A4(E29), V2|	3	Assignment	External	1
R272.	ESSENTIAL |(E47), R271|	3	Order	External	2
R273.	EQUALS |A4(E128), V26|	1	Assignment	External	1
R274.	EQUALS |A10(E161), V30|	3	Assignment	External	1
R275.	EQUALS |R274, R273|	3	Assignment	External	3
R276.	WILLRECEIVE |(E47), (E79), (E162)|	3	Order	Both	1
R277.	OWNS |(E4), (E79)|	1	Ownership	Internal	1
R278.	EQUALS |A4(E163), V96|	4	Assignment	External	1
R279.	EQUALS |A4(E163), V97|	4	Assignment	External	1
R280.	EQUALS |A4(E164), V98|	4	Assignment	External	1
R281.	IMPACT |A4(E47), (E54)|	3	Impact	Both	1
R282.	IMPACT |A4(E47), (E17)|	3	Impact	External	1
R283.	IMPACT |A4(E47), (E128)|	3	Impact	External	1
R284.	OWNS |(E165), (E47)|	3	Ownership	External	1
R285.	EQUALS |A50,R283, V59|	3	Assignment	External	2
R286.	IMPACT |A4(E47), A4(E4)|	3	Impact	Both	1
R287.	INCLUDE |(E116), (E47)|	3	Ownership	External	1
R288.	EQUALS |A10,R287, V13|	3	Assignment	External	2
R289.	EXCLUDE |(E116), (E47)|	3	Ownership	External	1
R290.	EQUALS |A10,R289, V13|	3	Assignment	External	2
R291.	DRIVINGFORCE |(E29), (E116)|	3	Order	External	1
R292.	IMPACT |A4(E47), A4(E29)|	3	Impact	External	1
R293.	WITHIN |(E161), (E4)|	3	Ownership	Both	1
R294.	EQUALS |A10,R293|	3	Assignment	Both	2
R295.	EQUALS |A18,R293, V99|	3	Assignment	Both	2
R296.	EQUALS |A18(E161), V100|	3	Assignment	External	1
R297.	DEPENDSON |OP263, OP283|	2	Order	Both	4
R298.	IMPLIES |OP17, R297|	2	Implication	Both	6
R299.	EQUALS |A69(E48), OP283|	2	Assignment	Both	3
R300.	BEFORE |OP284, OP263|	2	Order	External	4
R301.	ISAMEMBER |(E4), (E48)|	1	Ownership	Both	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R302.	ISAMEMBER I(E79), (E48)I	1	Ownership	Both	1
R303.	INCLUDES I(E116), R261I	2	Ownership	Both	2
R304.	EQUALS IA3(E92), V101I	1	Assignment	Both	1
R305.	INCLUDES I(E116), R304I	2	Ownership	Both	2
R306.	EQUALS IA3(E92), V102I	1	Assignment	Both	1
R307.	INCLUDES I(E116), R306I	2	Ownership	Both	2
R308.	IMPLIES I(E166), AND R24, OP294I	3	Implication	Both	3
R309.	OWNS I(E168), (E98)I	1	Ownership	External	1
R310.	EQUALS IA63(E50), V9I	1	Assignment	External	1
R311.	EQUALS IA70(E98), V104I	1	Assignment	External	1
R312.	INCLUDES I(E116), (E98)I	2	Ownership	External	1
R313.	IMPACT IA43(E98), (E169)I	3	Impact	External	1
R314.	EQUALS IA71(E98), (E4)I	1	Assignment	Both	1
R315.	EQUALS IA73(E75), (E98), V105I	1	Assignment	External	1
R316.	EQUALS IA35(E170), V39I	3	Assignment	Internal	1
R317.	EQUALS IA43(E120), A74(E120)I	2	Assignment	External	1
R318.	EQUALS IA35(E1), OP307, V39I	2	Assignment	Both	3
R319.	IMPACT I(E50), (E54)I	1	Impact	Both	1
R320.	EQUALS IA43(E98), V106I	1	Assignment	External	1
R321.	EQUALS IA3,R320, V107I	1	Assignment	External	2
R322.	EQUALS IA33(E50), V65I	1	Assignment	External	1
R323.	IFTHEN IR321, R322I	1	Assignment	External	4
R324.	EQUALS IA3,R320, V108I	1	Assignment	External	2
R325.	IFTHEN IR324, R109I	1	Assignment	External	4
R326.	EQUALS IA75,R52, V109I	2	Assignment	External	2
R327.	EQUALS IA18(E51), V110I	2	Assignment	External	1
R328.	DEPENDSON IOP313, A9(E51)I	2	Order	Both	3
R329.	WITH I(E171), OP313I	2	Order	Both	3
R330.	INCLUDES I(E116), (E51)I	2	Ownership	External	1
R331.	NOTEQUALS I(E1), (E172)I	2	Assignment	Both	1
R332.	HAS I(E116), (E155)I	2	Ownership	External	1
R333.	IFTHEN:EQUALS IR332, A33(E98), V70I	2	Assignment	External	2
R334.	EQUALS IA3,R241, V7I	2	Assignment	Internal	2
R335.	EQUALS IA5(E8), AND A5(E9), V3I	4	Assignment	Internal	1
R336.	EQUALS IA3,R335, AND A3,R11, V7I	4	Assignment	Internal	3
R337.	INCLUDES I(E117), R336I	4	Ownership	Both	4
R338.	EQUALS IA11(E155), V111I	2	Assignment	External	1
R339.	IMPLIES IOP322, R338I	2	Implication	Both	3
R340.	EQUALS IA43(E109), V106I	3	Assignment	Internal	1
R341.	EQUALS IA11,R340, V107I	3	Assignment	Internal	2
R342.	EQUALS IA5(E7), V3I	4	Assignment	Internal	1
R343.	INCLUDES I(E109), R342I	4	Ownership	Internal	2
R344.	IFTHEN:EQUALS IOP326, R342I	4	Assignment	Internal	4

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R345.	INCLUDES I(E109), (E98)I	3	Ownership	Both	1
R346.	EQUALS IA4(E98), V26I	1	Assignment	External	1
R347.	BEFORE IR346, R345I	3	Order	Both	3
R348.	EQUALS IA4(E98), V2I	1	Assignment	External	1
R349.	EQUALS IA11,R348, V112I	1	Assignment	External	2
R350.	IMPLIES IR349, AND R11, (E157)I	4	Implication	External	4
R351.	IMPACT I(E26), (E54)I	2	Impact	Internal	1
R352.	EQUALS IA50,R351, V59I	2	Assignment	Internal	2
R353.	IMPLIES I(E20), OP328I	2	Implication	Both	2
R354.	EQUALS IA11(E155), V113I	2	Assignment	External	1
R355.	IMPACT I(E20), R354I	2	Impact	External	2
R356.	IFTHEN:EQUALS IR354, A43(E108), V114I	2	Assignment	Both	2
R357.	EQUALS IA4(E20), V115I	1	Assignment	External	1
R358.	EQUALS IA10(E56), V13I	1	Assignment	External	1
R359.	EQUALS IA76(E63), AND A76(E174), V116I	1	Assignment	External	1
R360.	EQUALS IA10(E69), V13I	3	Assignment	External	1
R361.	IFTHEN:EQUALS IR360, A27(E29), V117I	3	Assignment	External	2
R362.	EQUALS IA4(E29), V118I	3	Assignment	External	1
R363.	IMPLIES IR83, OP329I	3	Implication	External	3
R364.	EQUALS IA3(E84), V119I	2	Assignment	External	1
R365.	IMPLIES IR83, R364I	3	Implication	External	3
R366.	EQUALS IA6(E26), V120I	2	Assignment	Internal	1
R367.	EQUALS IA6(E26), V121I	2	Assignment	Internal	1
R368.	WHILE IOP335, OP336I	2	Order	Both	3
R369.	EQUALS IA10(E176), V30I	1	Assignment	External	1
R370.	EQUALS IA11(E176), V122I	1	Assignment	External	1
R371.	NOTEQUALS IA36(E26), (E179)I	2	Assignment	Both	1
R372.	IMPACT IA6(E26), A9(E176)I	2	Impact	Both	1
R373.	EQUALS IA11(E176), V66I	1	Assignment	External	1
R374.	EQUALS IA3,OP348, V123I	2	Assignment	Both	2
R375.	INCLUDES I(E176), (E26), AND A6(E26)I	2	Ownership	Both	1
R376.	EQUALS IA3(E26), V124I	2	Assignment	Internal	1
R377.	IFTHEN:INCLUDES IR376, (E176), R376I	2	Ownership	Both	3
R378.	NOTEQUALS IA6(E26), V125, OR V126, OR V127I	2	Assignment	Internal	1
R379.	EQUALS IA76(E1), A6(E26), V128I	2	Assignment	Internal	1
R380.	EQUALS IA11,OP350, V129I	2	Assignment	Internal	2
R381.	BEFORE IOP351, R380I	2	Order	Internal	4
R382.	EQUALS IA3(E26), V119I	2	Assignment	Internal	1
R383.	NOTEQUAL IA11,OP352, V129I	2	Assignment	Internal	2
R384.	IMPACT IA3(E26), (E83)I	2	Impact	Internal	1
R385.	IMPACT I(E26), (E83)I	2	Impact	Internal	1
R386.	INCLUDES I(E116), R385I	2	Ownership	Both	2
R387.	IMPACT I(E20), (E54)I	1	Impact	Both	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R388.	EQUALS |A15(E102), V130|	2	Assignment	Internal	1
R389.	EQUALS |A11,R387, V131|	1	Assignment	Both	2
R390.	INCLUDE |(E180), R271, R388, AND R389|	3	Ownership	Both	5
R391.	IMPACT |(E53), (E54)|	2	Impact	Both	1
R392.	EQUALS |A11,R391, V132|	2	Assignment	Both	2
R393.	EQUALS |A3(E26), V102|	2	Assignment	Internal	1
R394.	EQUALS |A6(E26), V133|	2	Assignment	Internal	1
R395.	EQUALS |A33(E98), V86|	1	Assignment	External	1
R396.	IMPLIES |R393, R395|	2	Implication	Both	3
R397.	INCLUDES |(E116), (E180)|	2	Ownership	External	1
R398.	NEGATIVEIMPACT |OP361, (E116)|	2	Impact	Both	2
R399.	EQUALS |A4(E173), V2|	2	Assignment	Internal	1
R400.	EQUALS |A4(E173), V26|	2	Assignment	Internal	1
R401.	EQUALS |A72,R400, A72,R399|	2	Assignment	Internal	3
R402.	GREATERTHAN |A72,R400, A72,R399|	2	Assignment	Internal	3
R403.	EQUALS |A6,R402, A72(E181)|	2	Assignment	Internal	4
R404.	INCLUDES |(E182), (E116)|	2	Ownership	Both	1
R405.	EQUALS |A3(E182), V134|	1	Assignment	Both	1
R406.	INCLUDES |(E182), (E26)|	2	Ownership	External	1
R407.	EQUALS |A18(E116), V135|	2	Assignment	External	1
R408.	INCLUDES |(E182), R407|	2	Ownership	Both	2
R409.	EQUALS |A3(E26), V136|	2	Assignment	Internal	1
R410.	INCLUDE |(E116), R409|	2	Ownership	Both	2
R411.	IFTHEN:EQUALS |R409, (E108)|	2	Assignment	Internal	2
R412.	EQUALS |A43(E7), V137|	4	Assignment	Internal	1
R413.	NOTEQUALS |A43(E7), V138|	4	Assignment	Internal	1
R414.	IMPACT |A4(E29), (E54)|	3	Impact	Both	1
R415.	EQUALS |A3,R83, V139|	3	Assignment	External	2
R416.	INCLUDE |(E116), R415|	3	Ownership	External	3
R417.	INCLUDE |(E116), R415, AND (E26)|	3	Ownership	Both	3
R418.	OWNS |(E183), (E119)|	2	Ownership	External	1
R419.	OWNS |(E184), (E110)|	4	Ownership	Internal	1
R420.	OWNS |(E79), (E110)|	4	Ownership	Internal	1
R421.	EQUALS |A9(E20), V8|	1	Assignment	External	1
R422.	EQUALS |A6(E185), OP372|	2	Assignment	Both	2
R423.	EQUALS |A10(E52), V13|	2	Assignment	External	1
R424.	INCLUDES |(E186), OP373, R423, AND R83|	3	Ownership	External	4
R425.	EQUALS |A10(E186), V13|	1	Assignment	Both	1
R426.	IFTHEN:IMPACTEQUALS |R425, R393, (E54),	2	Impact	Both	3
R427.	EQUALS |A10(E187), V13|	1	Assignment	Both	1
R428.	INCLUDE |(E108), (E188)|	3	Ownership	Both	1
R429.	INCLUDES |(E51), (E188)|	3	Ownership	External	1
R430.	EQUALS |A18(E116), V110|	2	Assignment	External	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R431.	WILLEQUAL |A4(E29), V26|	3	Assignment	External	1
R432.	INCLUDES |(E180), R431, AND R271|	3	Ownership	External	3
R433.	IFTHEN:EQUALS |R432, A76(E72), V141|	3	Assignment	External	4
R434.	NOIMPACT |R393, (E189)|	2	Impact	Internal	2
R435.	EQUALS |A62,R434, V142|	2	Assignment	Internal	3
R436.	IMPACT |(E26), (E84)|	2	Impact	Both	1
R437.	EQUALS |A43(E108), V143|	2	Assignment	Internal	1
R438.	EQUAL |A18(E190), V144|	2	Assignment	External	1
R439.	NOTEQUALS |A12,R438, V145|	2	Assignment	External	2
R440.	EQUALS |A12(E190), V145|	2	Assignment	External	1
R441.	EQUALS |A18, OP389|	2	Assignment	External	3
R442.	EQUALS |A4(E41), V149|	2	Assignment	Internal	1
R443.	EQUALS |A79(E41), V148|	2	Assignment	Internal	1
R444.	EQUALS |A78(E41), V147|	2	Assignment	Internal	1
R445.	EQUALS |A4(E29), V150|	3	Assignment	External	1
R446.	EQUALS |A73(E1), OP5, V151|	3	Assignment	Both	2
R447.	WASEQUAL |A4(E29), V2|	3	Assignment	External	1
R448.	BEFORE |R447, OP394|	3	Order	External	3
R449.	EQUALS |A4(E191), V2|	2	Assignment	Internal	1
R450.	EQUALS |(E134), A80,R449|	2	Assignment	External	2
R451.	EQUALS |A15(E31), V54|	2	Assignment	Internal	1
R452.	EQUALS |A4(E192), V2|	1	Assignment	Internal	1
R453.	EQUALS |A10(E123), V13|	2	Assignment	Internal	1
R454.	IMPACTS |R453, R452|	2	Impact	Internal	3
R455.	EQUALS |A15(E193), V54|	1	Assignment	Internal	1
R456.	IMPLIES |R451, R455|	2	Implication	Internal	3
R457.	EQUALS |(E134), OP398|	4	Assignment	Both	5
R458.	EQUALS |A73(E1), (E24), V8|	2	Assignment	Both	1
R459.	EQUALS |A11,OP401, V129|	2	Assignment	Both	2
R460.	EQUALS |A4(E31), V152|	2	Assignment	Internal	1
R461.	EQUALS |A4,OP407, V153|	2	Assignment	Internal	2
R462.	EQUALS |A3,R50, A3,R461|	2	Assignment	Internal	4
R463.	EQUALS |A4(E29), V154|	3	Assignment	External	1
R464.	NOIMPACT |R463, AND R30, A4(E41)|	3	Impact	Both	3
R465.	EQUALS |A9(E31), V155|	2	Assignment	Internal	1
R466.	EQUALS |A50(E31), V156|	2	Assignment	Internal	1
R467.	EQUALS |A4(E195), V26|	1	Assignment	External	1
R468.	MOREDIFFICULT |OP416, OP417|	1	Assignment	External	4
R469.	NOTINCLUDES |A82(E58), (E31)|	2	Ownership	Internal	1
R470.	INCLUDES |A82(E199), (E31)|	2	Ownership	Both	1
R471.	DEPENDSON |A4(E41), A4(E31)|	2	Order	Internal	1
R472.	IFTHEN:EQUALS |R453, (E134), R8, AND R6|	4	Assignment	Both	4
R473.	AFTER:EQUALS |OP427, A4(E200), V157|	1	Assignment	External	2

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R474.	EQUALS |A10(E201), V13|	1	Assignment	Internal	1
R475.	IFTHEN :EQUALS |R50, A6,R50, R474|	2	Assignment	Internal	4
R476.	EQUALS |A3(E201), V158|	1	Assignment	Internal	1
R477.	INCLUDES |A43(E4), V159|	1	Ownership	Internal	1
R478.	INCLUDES |A43(E4), V67|	1	Ownership	Internal	1
R479.	INCLUDES |A83(E202), V160|	1	Ownership	External	1
R480.	EQUALS |A26,R479, (E203)|	3	Assignment	Both	2
R481.	EQUALS |A4(E126), V154|	3	Assignment	Internal	1
R482.	EQUALS |(E204), (E205)|	2	Assignment	Both	1
R483.	EQUALS |A84(E205), V161, AND V162|	2	Assignment	Both	1
R484.	IMPLIES |A17(E37), R483|	2	Implication	Both	2
R485.	IMPLIES |(E34), OP441|	3	Implication	Internal	2
R486.	EQUALS |A4(E126), V2|	3	Assignment	Internal	1
R487.	EQUALS |A50(E34), V163|	3	Assignment	Internal	1
R488.	EQUALS |A86(E126), V164|	3	Assignment	Internal	1
R489.	CONTRIBUTESTO |(E34), R488|	3	Impact	Internal	2
R490.	CONTINUESTOEQUAL |A4(E126), V2|	3	Assignment	Internal	1
R491.	CONTINUESTOEQUAL |A10(E206), V13|	3	Assignment	Internal	1
R492.	IFTHEN |R490, R491|	3	Assignment	Internal	3
R493.	EQUALS |A43(E4), V67|	1	Assignment	Internal	1
R494.	IMPLIES |R493, OP448|	3	Implication	Both	3
R495.	IMPLIES |R72, R494|	3	Implication	Both	5
R496.	IMPACTS |A85,R486, OP450|	3	Impact	Both	3
R497.	EQUALS |A9,OP454, V165|	2	Assignment	External	2
R498.	EQUALS |A12,OP458, V166|	1	Assignment	External	2
R499.	EQUALS |A35,OP464, V39|	3	Assignment	Internal	2
R500.	EQUALS |A66,OP443, V70|	3	Assignment	Internal	2
R501.	IMPLIES |R493, R500|	3	Implication	Internal	4
R502.	EQUALS |A12(E210), (E132)|	4	Assignment	External	1
R503.	EQUALS |A76(E38), V167|	2	Assignment	External	1
R504.	EQUALS |A66,OP475, V65|	2	Assignment	Both	3
R505.	IMPLIES |R503, R504|	2	Implication	Both	5
R506.	EQUALS |A85,OP443, V168|	3	Assignment	Internal	2
R507.	IFTHEN:EQUALS |R506, A3,OP8, V101|	3	Assignment	Both	4
R508.	EQUALS |A9,OP450, V169|	2	Assignment	Both	2
R509.	EQUALS |A9,OP480, V170|	2	Assignment	Both	3
R510.	EQUALS |A9,R50, V171|	2	Assignment	Internal	2
R511.	EQUALS |A9(E134), V161|	1	Assignment	Both	1
R512.	EQUALS |A15(E54), V172|	1	Assignment	Internal	1
R513.	IMPACTS |OP489, A80,OP488|	2	Impact	Internal	4
R514.	IMPACT |(E116), (E212)|	2	Impact	External	1
R515.	EQUALS |A15(E54), V173|	1	Assignment	Internal	1
R516.	EQUALS |A4(E41), V174|	2	Assignment	Internal	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R517.	IMPLIES |A45(E212), OP495|	2	Implication	Both	3
R518.	IMPACTS |(E186), (E54)|	1	Impact	External	1
R519.	EQUALS |A6,R50, (E92)|	2	Assignment	External	2
R520.	IMPACT |R519, (E54)|	2	Impact	Both	3
R521.	IMPACTS |R50, (E213)|	2	Impact	Both	2
R522.	EQUALS |A50,R521, V59|	2	Assignment	Both	3
R523.	EQUALS |A62(E17), V175|	2	Assignment	External	1
R524.	EQUALS |A90(E17), V176|	2	Assignment	External	1
R525.	EQUALS |A4(E44), V2|	1	Assignment	External	1
R526.	EQUALS |A11,R525, V129|	1	Assignment	External	2
R527.	EQUALS |A3,R50, V177|	2	Assignment	Internal	2
R528.	EQUALS |A11,OP15, V178|	2	Assignment	Both	2
R529.	WHATIS |A3(E92)|	1	Assignment	Both	1
R530.	WHATIS |A55(E92)|	1	Assignment	Both	1
R531.	IMPLIES |A6(E92), A3(E92)|	1	Implication	Both	1
R532.	WHATIS |A39(E44)|	1	Assignment	External	1
R533.	INCLUDES |(E116), (E44), AND R50|	2	Ownership	Both	2
R534.	EQUALS |A92(E130), OP515, OR OP518|	2	Assignment	External	3
R535.	DIFFERENCE |V22, A11(E214)|	1	Assignment	External	1
R536.	EQUALS |R535, V179|	1	Assignment	External	2
R537.	EQUALS |A11,OP13, V22|	2	Assignment	Both	2
R538.	NOTEQUALS |A11,OP15, V61|	2	Assignment	Both	2
R539.	EQUALS |A11,OP15, V180|	2	Assignment	Both	2
R540.	EQUALS |A6,(E214), OP532, AND OP533|	2	Assignment	Both	6
R541.	NOTEQUAL |A84(E40), A84(E1)|	2	Assignment	Both	1
R542.	EQUALS |A84(E1), A94(E41), V181|	2	Assignment	Internal	1
R543.	EQUALS |A3(E92), A3,R50|	2	Assignment	External	2
R544.	EQUALS |A11(E214), V180|	1	Assignment	External	1
R545.	IMPLIES |R544, OP556|	2	Implication	External	3
R546.	WHATIS |A1(E186)|	1	Assignment	Both	1
R547.	EQUALS |A9,R546, V182|	1	Assignment	Both	2
R548.	WHATIS |A39,OP558|	2	Assignment	External	3
R549.	EQUALS |A55,R548, (E215)|	2	Assignment	Both	4
R550.	EQUALS |A11,OP564, V183|	2	Assignment	External	2
R551.	EQUALS |A11,OP72|	2	Assignment	External	2
R552.	NOTEQUALS |A11(E57), V184|	2	Assignment	External	1
R553.	EQUALS |A11,OP571, V185|	2	Assignment	External	2
R554.	INCLUDES |R553, OP574|	2	Ownership	Both	5
R555.	NOIMPACT |OP574, (E54)|	2	Impact	Both	3
R556.	EQUALS |A3(E54), V186|	1	Assignment	Internal	1
R557.	EQUALS |A35, OP575, V39|	2	Assignment	Internal	3
R558.	EQUALS |A9(E20), V187|	1	Assignment	External	1
R559.	EQUALS |A18(E190), V50|	2	Assignment	External	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R560.	INCLUDES I(E51), R559I	2	Ownership	External	2
R561.	IMPACT IR50, (E54)I	2	Impact	Internal	2
R562.	DOESNOTINCLUDE IA98(E1), OP263I	2	Ownership	Internal	2
R563.	INCLUDES IA98(E1), OP579I	2	Ownership	External	2
R564.	EQUALS IA4(E47), V188I	3	Assignment	External	1
R565.	EQUALS IA96,OP582, V189I	3	Assignment	External	3
R566.	IMPLIES I(E50), OP587I	2	Implication	Both	4
R567.	EQUALS IA10(E50), V13I	1	Assignment	External	1
R568.	WITH IR567, OP589I	2	Order	Both	3
R569.	EQUALS IA9,R568, V190I	2	Assignment	Both	4
R570.	IMPLIES IA99(E50), OP590I	3	Implication	Both	2
R571.	EQUALS IA33(E6), V191I	3	Assignment	Internal	1
R572.	IMPLIES IR14, R571I	4	Implication	Internal	3
R573.	EQUALS IA10(E109), V30I	3	Assignment	Internal	1
R574.	EQUALS IA9(E51), V192I	2	Assignment	External	1
R575.	EQUALS IA18(E190), V193I	2	Assignment	External	1
R576.	INCLUDES I(E51), R575I	2	Ownership	External	2
R577.	EQUALS IA10(E96), V30I	3	Assignment	External	1
R578.	NOTEQUALS IA11,OP598, V194I	3	Assignment	External	2
R579.	EQUALS IA9,OP599, V195I	2	Assignment	External	2
R580.	IFTHEN:IMPLIES IR578, R577, R579I	3	Implication	External	6
R581.	EQUALS IA9,R49, V8I	3	Assignment	External	2
R582.	WHATIS I(E50), A4(E47)I	3	Assignment	External	1
R583.	EQUALS IA76(E1), (E50), V151I	2	Assignment	Both	1
R584.	EQUALS IA33(E50), V196I	1	Assignment	External	1
R585.	IMPLIES IOP606, R584I	4	Implication	Both	3
R586.	LESSTHAN IA102,OP608, A102,OP609I	4	Assignment	Both	3
R587.	EQUALS IA10(E134), V197I	1	Assignment	Both	1
R588.	EQUALS IA103,OP611, V170I	2	Assignment	Both	3
R589.	IMPLIES IR587, AND A4(E47), R588I	3	Implication	Both	5
R590.	EQUALS IA9,OP615, V198I	2	Assignment	Internal	3
R591.	IMPLIES IR562, R590I	2	Implication	Internal	6
R592.	EQUALS IA11(E98), V199I	1	Assignment	External	1
R593.	IMPLIES I(E50), OP622I	2	Implication	Both	4
R594.	EQUALS IA6(E26), V17I	2	Assignment	Internal	1
R595.	EQUALS IA6(E26), V200, OR V195I	2	Assignment	Internal	1
R596.	EQUALS IA4(E220), V201I	2	Assignment	Internal	1
R597.	EQUALS IA6,OP629, OP631I	3	Assignment	Internal	4
R598.	EQUALS IA39(E26), V84I	2	Assignment	Internal	1
R599.	EQUALS IA6,OP629, OP632I	3	Assignment	Internal	4
R600.	NOTEQUALS IA3(E26), V202I	2	Assignment	Internal	1
R601.	IMPACTS IR600, (E83)I	2	Impact	Internal	2
R602.	EQUALS IA6,OP629, OP633I	3	Assignment	Internal	5

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R603.	IMPACTS |(E26), (E41)|	2	Impact	Internal	1
R604.	LEADTO |(E221), OP352|	2	Order	External	2
R605.	WHATIS |A1(E26)|	2	Assignment	Internal	1
R606.	EQUALS |A4, R605, V149|	2	Assignment	Internal	2
R607.	EQUALS |A3(E26), V203, OR V57|	2	Assignment	Internal	1
R608.	IFTHEN:IMPACTS |R607, (E26), (E222), AND (E2..	3	Impact	Internal	2
R609.	IMPLIES |A6(E26), R607|	2	Implication	Internal	2
R610.	IMPACT |(E26), A26(E83)|	2	Impact	Internal	1
R611.	DEPENDSON |R610, A22(E26)|	2	Order	Internal	2
R612.	INCLUDES |(E111), OP644|	3	Ownership	Both	2
R613.	EQUALS |A4(E221), V89|	1	Assignment	Both	1
R614.	EQUALS |A12(E221), (E41)|	2	Assignment	External	1
R615.	EQUALS |A9, R614, V204|	2	Assignment	External	2
R616.	EQUALS |A6(E26), V195|	2	Assignment	Internal	1
R617.	EQUALS |A9,R616, V36|	2	Assignment	Internal	2
R618.	EQUALS |A4(E221), V205|	1	Assignment	Both	1
R619.	EQUALS |A3,R50, A3,R618|	2	Assignment	External	3
R620.	IMPACT |R50, (E83)|	2	Impact	Internal	2
R621.	OWNS |(E22), (E226)|	1	Ownership	External	1
R622.	FUNDEDBY |(E227), (E102)|	2	Ownership	Internal	1
R623.	EQUALS |A6,OP657, OP658|	2	Assignment	Both	4
R624.	EQUALS |A6(E228), V206|	2	Assignment	Internal	1
R625.	EQUALS |A6,OP657, OP659|	2	Assignment	Both	4
R626.	IMPACTS |(E56), (E54)|	1	Impact	Both	1
R627.	EQUALS |A6,OP657, OP660|	2	Assignment	Both	4
R628.	EQUALS |A6,OP661, OP663|	2	Assignment	Both	3
R629.	IMPACT |(E56), (E233)|	2	Impact	External	1
R630.	EQUALS |A3(E234), V207|	1	Assignment	Internal	1
R631.	EQUALS |A18(E234), V110|	1	Assignment	Internal	1
R632.	EQUALS |A12,R631, (E79)|	1	Assignment	Internal	2
R633.	EQUALS |A105(E69), V208|	3	Assignment	External	1
R634.	EQUALS |A105(E235), V208|	1	Assignment	External	1
R635.	IMPLIES |R634, R633|	3	Implication	External	3
R636.	IMPLIES |(E69), OP665|	3	Implication	Both	2
R637.	EQUALS |A3,OP666, V209|	2	Assignment	Internal	3
R638.	EQUALS |A66(E234), V210|	1	Assignment	Internal	1
R639.	EQUALS |A3,OP667, V211|	2	Assignment	Both	2
R640.	IMPACT |(E69), (E106)|	3	Impact	Both	1
R641.	IMPACTS |A26,OP671, OP672|	3	Impact	Both	3
R642.	IMPACTS |(E20), (E106)|	1	Impact	Both	1
R643.	IMPACTS |(E20), (E117)|	2	Impact	External	1
R644.	IMPACTS |(E20), (E54)|	1	Impact	Both	1
R645.	EQUALS |A4(E56), V212|	1	Assignment	External	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R646.	EQUALS |A84(E1), V162|	2	Assignment	Internal	1
R647.	EQUALS |A84(E1), V213|	2	Assignment	Internal	1
R648.	MORETHAN |R647, R646|	2	Assignment	Internal	3
R649.	IMPACTS |A4(E8), A4(E9), AND A4(E7)|	4	Impact	Internal	1
R650.	EQUALS |A6,R34, V214|	4	Assignment	Internal	2
R651.	EQUALS |A11,OP705, V129|	4	Assignment	Internal	2
R652.	IMPLIES |R650, R651|	4	Implication	Internal	5
R653.	EQUALS |A11,OP263, V215|	2	Assignment	Internal	2
R654.	EQUALS |A6(E221), R653|	2	Assignment	External	3
R655.	WHATIS |A108,R34|	4	Assignment	Internal	2
R656.	EQUALS |A10,R655, V13|	4	Assignment	Internal	3
R657.	EQUALS |A80(E1), (E41), V216|	2	Assignment	Internal	1
R658.	BEFORE |A45(E54), A45(E31), AND A45(E41),	2	Order	Internal	2
R659.	IMPACT |(E52), (E83), AND A1(E84)|	2	Impact	Both	1
R660.	COULDIMPACT |(E27), A4(E41)|	2	Impact	Both	1
R661.	EQUALS |A4(E8), V26|	4	Assignment	Internal	1
R662.	IMPACTS |R661, AND A19,OP705, (E117)|	4	Impact	Both	3
R663.	IMPACTS |(E27), (E117)|	2	Impact	External	1
R664.	INCLUDES |(E116), R663|	2	Ownership	External	2
R665.	EQUALS |A9(E155), V217|	2	Assignment	External	1
R666.	IMPLIES |(E116), R665|	2	Implication	External	2
R667.	EQUALS |A4(E41), V218|	2	Assignment	Internal	1
R668.	ENABLES |R163, OP722|	2	Order	Both	5
R669.	RELATIVETO |A4(E29), A6,OP5|	3	Order	External	2
R670.	IMPACTS |OP5, A4(E29)|	3	Impact	External	2
R671.	IMPACTS |OP5, (E84)|	3	Impact	External	2
R672.	EQUALS |A3,R83, V219|	3	Assignment	External	2
R673.	IMPACTS |OP728, (E84), A11(E84)|	2	Impact	External	2
R674.	IMPACTS |R672, R673|	3	Impact	External	5
R675.	IMPACTS |OP5, (E183)|	3	Impact	External	2
R676.	EQUALS |A10(E239), V13|	1	Assignment	Internal	1
R677.	WHATIS |A11,R5|	3	Assignment	Internal	2
R678.	IMPACTS |R72, OP743|	3	Impact	Both	3
R679.	EQUALS |A4(E190), V220|	2	Assignment	External	1
R680.	INCLUDES |(E111), R679|	3	Ownership	Both	2
R681.	EQUALS |A18(E241), V221|	1	Assignment	Both	1
R682.	EQUALS |A11,OP739, V222|	3	Assignment	Internal	2
R683.	EQUALS |A112(E126), (E242)|	3	Assignment	Both	1
R684.	BECAUSE:IMPACTS |R683, OP8, (E222)|	3	Impact	Both	3
R685.	INCLUDES |(E109), (E110), AND (E243)|	4	Ownership	Both	1
R686.	EQUALS |A3(E109), A3(E244), AND A3,OP757|	3	Assignment	Both	2
R687.	NOIMPACT |A4(E126), (E79)|	3	Impact	Internal	1
R688.	EQUALS |A113(E79), (E242)|	3	Assignment	Both	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R689.	EQUALS |A3,R687, V87|	3	Assignment	Internal	2
R690.	EQUALS |A102,R688, V223|	3	Assignment	Both	2
R691.	IMPLIES |R690, R689|	3	Implication	Both	5
R692.	EQUALS |A4(E218), V86|	4	Assignment	Internal	1
R693.	IMPLIES |A4(E126), R692|	4	Implication	Internal	2
R694.	IMPACTS |R693, (E222)|	4	Impact	Internal	3
R695.	EQUALS |A6(E110), OP760|	4	Assignment	Internal	5
R696.	WHATIS |A37(E1), A65(E146)|	2	Assignment	Both	1
R697.	WHATIS |A39,OP767|	2	Assignment	Both	2
R698.	EQUALS |A10, R697, V13|	2	Assignment	Both	3
R699.	EQUALS |A3(E206), V225|	3	Assignment	Internal	1
R700.	EQUALS |A9(E206), V224|	3	Assignment	Internal	1
R701.	IMPLIES |R700, R699|	3	Implication	Internal	3
R702.	EQUALS |A9(E247), V226|	3	Assignment	Internal	1
R703.	EQUALS |A78(E247), V147|	3	Assignment	Internal	1
R704.	WHATIS |A17(E37)|	1	Assignment	Both	1
R705.	EQUALS |A114,R704, V17|	1	Assignment	Both	2
R706.	EQUALS |A115(E1), OP785|	2	Assignment	Both	2
R707.	EQUALS |A35,OP788, V208|	3	Assignment	Internal	3
R708.	BECAUSE:NOIMPACT |OP790, (E39), (E54)|	2	Impact	Both	2
R709.	EQUALS |A11,OP793, V83|	1	Assignment	External	2
R710.	EQUALS |A116,OP12, (E4)|	2	Assignment	Both	2
R711.	EQUALS |A62,OP795, V227|	2	Assignment	Internal	2
R712.	EQUALS |A6,OP793, OP796|	2	Assignment	Both	5
R713.	OF |(E92), (E41)|	2	Ownership	External	1
R714.	OF |(E92), (E251)|	1	Ownership	External	1
R715.	IMPLIES |R713, R714|	2	Implication	External	3
R716.	EQUALS |A11,OP806, V129|	2	Assignment	External	2
R717.	EQUALS |A4(E134), V228|	1	Assignment	Both	1
R718.	EQUALS |A4(E253), V228|	1	Assignment	Both	1
R719.	INCLUDES |(E116), (E92), A55(E92), AND (E221)|	2	Ownership	Both	1
R720.	IMPACTS |R50, (E155)|	2	Impact	Both	2
R721.	INCLUDES |(E268), A97,OP822|	2	Ownership	Both	4
R722.	EQUALS |A11,OP828, V229|	2	Assignment	Internal	2
R723.	DOESNOTOWN |(E4), (E47)|	3	Ownership	Both	1
R724.	OWNS |(E4), (E47)|	3	Ownership	Both	1
R725.	EQUALS |A3,R724, V230|	3	Assignment	Both	2
R726.	EQUALS |A11,OP833, V231|	3	Assignment	External	2
R727.	IMPACTS |R726, (E54)|	3	Impact	Both	3
R728.	IMPACTS |R726, (E256)|	3	Impact	External	3
R729.	IMPACTS |R728, (E54)|	3	Impact	Both	4
R730.	EQUALS |A4(E48), V232|	1	Assignment	External	1
R731.	FROM |(E252), (E92)|	1	Ownership	Both	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R732.	EQUALS |A9(E257), V233, AND V234|	3	Assignment	Internal	1
R733.	EQUALS |A9(E80), V84|	1	Assignment	Internal	1
R734.	EQUALS |A6,OP847, OP848|	3	Assignment	Internal	4
R735.	EQUALS |A34(E257), V235|	3	Assignment	Internal	1
R736.	EQUALS |A11,OP849, V71|	3	Assignment	Internal	3
R737.	EQUALS |A117(E257), V204|	3	Assignment	Internal	1
R738.	IMPLIES |R737, OP850|	3	Implication	Internal	3
R739.	IMPACTS |(E50), A11,OP853, AND A72,OP853|	1	Impact	External	3
R740.	INSTEADOF |OP856, (E218), AND (E258)|	4	Order	Both	3
R741.	INCLUDES |(E116), (E50)|	2	Ownership	External	1
R742.	IMPACTS |(E52), (E54)|	2	Impact	Both	1
R743.	EQUALS |A9(E52), V237|	2	Assignment	External	1
R744.	DOESNOTINCLUDE |(E116), (E155)|	2	Ownership	External	1
R745.	IMPACTS |(E52), A118,OP868|	2	Impact	Both	2
R746.	EQUALS |A10(E252), V13|	1	Assignment	Both	1
R747.	SUFFICENTLYEXCEEDS |(E83), (E84)|	2	Assignment	Both	1
R748.	IMPACTS |R747, A118,OP869|	2	Impact	Both	4
R749.	IMPACTS |(E186), (E117)|	2	Impact	Both	1
R750.	EQUALS |A9(E26), V238|	2	Assignment	Internal	1
R751.	EQUALS |A3(E26), V57|	2	Assignment	Internal	1
R752.	EQUALS |A3(E26), V239|	2	Assignment	Internal	1
R753.	WHATIS |A120(E26)|	2	Assignment	Internal	1
R754.	EQUALS |A10,R753, V13|	2	Assignment	Internal	2
R755.	EQUALS |A11(E20), V83|	1	Assignment	External	1
R756.	EQUALS |A18,OP884, V110|	2	Assignment	External	2
R757.	NOIMPACT |(E56), (E102)|	2	Impact	Both	1
R758.	WHATIS |A122(E101)|	2	Assignment	External	1
R759.	WHATIS |A84(E22), R758|	2	Assignment	External	2
R760.	EQUALS |A73(E1), (E69), V151|	3	Assignment	Both	1
R761.	EQUALS |A10(E77), V30|	1	Assignment	Both	1
R762.	IMPACTS |A94(E261), (E262)|	2	Impact	External	1
R763.	EQUALS |A6,OP892, OP891|	2	Assignment	Both	5
R764.	IMPACTS |(E69), (E79)|	3	Impact	Both	1
R765.	WHATIS |A120(E186)|	1	Assignment	Both	1
R766.	EQUALS |A9(E87), V240|	1	Assignment	Both	1
R767.	EQUALS |A10,R765, V13|	1	Assignment	Both	2
R768.	EQUALS |A63(E30), V9|	1	Assignment	Both	1
R769.	OF |(E263), (E264)|	2	Ownership	External	1
R770.	EQUALS |A11(E264), V147|	1	Assignment	External	1
R771.	EQUALS |A63,R769, V241|	2	Assignment	External	2
R772.	IMPLIES |OP901, OP902|	2	Implication	External	3
R773.	EQUALS |A11,OP903, V242|	2	Assignment	External	2
R774.	WHATIS |A124(E41)|	2	Assignment	Internal	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R775.	EQUALS |A123,R774, V18|	2	Assignment	Internal	2
R776.	EQUALS |A124(E41), V243|	2	Assignment	Internal	1
R777.	EQUALS |A11,OP905, V22|	2	Assignment	Internal	2
R778.	IFTHEN:EQUALS |R777, R776|	2	Assignment	Internal	4
R779.	DOESNOTEQUAL |A94(E31), V244|	2	Assignment	Internal	1
R780.	EQUALS |A11,OP908, V245|	2	Assignment	Internal	2
R781.	IMPLIES |R780, OP907|	2	Implication	Internal	4
R782.	WHATIS |A94(E31)|	2	Assignment	Internal	1
R783.	EQUALS |A94(E31), V246|	2	Assignment	Internal	1
R784.	IFTHEN:EQUALS |R783, A11,R782, V147|	2	Assignment	Internal	3
R785.	WHATIS |A55,OP909|	2	Assignment	Internal	2
R786.	DEPENDSON |OP912, A123(E41)|	2	Order	Internal	2
R787.	EQUALS |A10(E266), V13|	2	Assignment	Internal	1
R788.	HIGHERTHAN |A35(E266), A35,OP914|	2	Assignment	Both	2
R789.	WHATIS |A94(E8)|	4	Assignment	Internal	1
R790.	IMPLIES |OP5, OP922|	3	Implication	External	3
R791.	EQUALS |A6,OP5, V247|	3	Assignment	External	2
R792.	WHATIS |A94(E29)|	3	Assignment	External	1
R793.	WHATIS |A94(E262)|	2	Assignment	External	1
R794.	EQUALS |A9,R792, A9,R793|	3	Assignment	External	3
R795.	IMPACTS |(E27), (E54)|	2	Impact	Both	1
R796.	IMPACTS |(E27), (E256)|	2	Impact	External	1
R797.	EQUALS |A85(E190), V248|	2	Assignment	External	1
R798.	IFTHEN:MINIMALIMPACT |R797, (E27), (E54)|	2	Impact	Both	2
R799.	EQUALS |A18,R798, V249|	2	Assignment	Both	3
R800.	INCLUDES |A98(E1), OP937|	2	Ownership	Internal	2
R801.	EQUALS |A94,OP937, V250|	2	Assignment	Internal	2
R802.	EQUALS |A3,R801, V251|	2	Assignment	Internal	3
R803.	EQUALS |A84(E38), V147|	2	Assignment	External	1
R804.	EQUALS |A94,OP11, V252|	2	Assignment	Both	2
R805.	EQUALS |A4(E106), V2|	1	Assignment	Internal	1
R806.	INCLUDES |A98(E1), OP938, AND OP939|	2	Ownership	Internal	4
R807.	EQUALS |A9(E76), V253|	3	Assignment	Internal	1
R808.	WHATIS |A4(E126), V254|	3	Assignment	Internal	1
R809.	BECAUSE:EQUALS |R807, A50,R808|	3	Assignment	Internal	3
R810.	EQUALS |A114,R704, V255|	1	Assignment	Both	2
R811.	WHATIS |A11,OP946|	2	Assignment	Internal	2
R812.	EQUALS |A62,OP949, V256|	1	Assignment	Both	2
R813.	INCLUDES |A98(E4), R812|	1	Ownership	External	3
R814.	EQUALS |A84(E1), V258|	2	Assignment	Internal	1
R815.	EQUALS |A35,OP955, V257|	1	Assignment	External	2
R816.	IMPLIES |R815, R814|	2	Implication	Both	4
R817.	EQUALS |A114,R704, V259|	1	Assignment	Both	2

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R818.	EQUALS |A84(E1), R704, V260|	2	Assignment	External	2
R819.	WHATIS |A43(E6)|	3	Assignment	Internal	1
R820.	EQUALS |A85,R819, V261|	3	Assignment	Internal	2
R821.	WHATIS |A99,OP739|	3	Assignment	Internal	2
R822.	EQUALS |A10,R821, V13|	3	Assignment	Internal	3
R823.	IMPLIES |(E143), R822|	3	Implication	Both	4
R824.	EQUALS |A9,OP739, V262, AND V263|	3	Assignment	Internal	2
R825.	WHATIS |A4(E6)|	3	Assignment	Internal	1
R826.	EQUALS |A9,OP964, V264|	2	Assignment	Internal	2
R827.	INCLUDES |(E268), OP965|	2	Ownership	Both	2
R828.	EQUALS |A9,OP967, V264|	2	Assignment	Internal	4
R829.	PERTAININGTO |(E269), R47|	2	Ownership	Both	3
R830.	DRAWSHEAVILYFROM |(E268), R829|	2	Order	Both	4
R831.	INCLUDES |(E268), A3(E92)|	1	Ownership	External	1
R832.	IMPACTS |(E92), (E46)|	2	Impact	External	1
R833.	INCLUDES |(E268), (E46)|	2	Ownership	Internal	1
R834.	EQUALS |A4(E44), V265|	1	Assignment	External	1
R835.	INCLUDES |(E116), (E44)|	2	Ownership	External	1
R836.	WHATIS |A11,R834|	1	Assignment	External	2
R837.	EQUALS |A96,R836, V29|	1	Assignment	External	3
R838.	INCLUDES |(E268), OP976|	2	Ownership	Both	4
R839.	EQUALS |A9,R838, V264|	2	Assignment	Both	5
R840.	IMPACTS |(E92), (E54)|	1	Impact	External	1
R841.	INCLUDES |(E268), A121(E45)|	1	Ownership	Both	1
R842.	WHATIS |A121(E45)|	1	Assignment	External	1
R843.	EQUALS |A9,OP991, V266|	1	Assignment	External	2
R844.	OF |A60(E45), (E44)|	1	Ownership	External	1
R845.	MEMBERSOF |A126,OP14, (E45)|	1	Ownership	External	2
R846.	EQUALS |A18,R845, V86|	1	Assignment	External	3
R847.	INREFERENCETO |A130(E271), (E44)|	1	Order	External	1
R848.	IMPLIES |R45, OP996|	1	Implication	External	3
R849.	NOIMPACT |(E39), (E17)|	2	Impact	External	1
R850.	DOESNOTOWN |(E1), (E47)|	3	Ownership	Both	1
R851.	EQUALS |A73(E1), (E47), V267|	3	Assignment	Both	1
R852.	BECAUSE:EQUALS |R284, A73(E165), (E47),	3	Assignment	External	2
R853.	IMPACTS |A4(E47), (E54)|	3	Impact	Both	1
R854.	NOIMPACT |A4(E47), (E54)|	3	Impact	Both	1
R855.	EQUALS |A3,R854, V251|	3	Assignment	Both	2
R856.	OF |(E273), (E106)|	1	Ownership	Internal	1
R857.	EQUALS |A102,R856, V269|	1	Assignment	Internal	2
R858.	OF |(E273), (E274)|	1	Ownership	Both	1
R859.	EQUALS |A102,R858, V270|	1	Assignment	Both	2
R860.	EQUALS |A9(E98), V271|	1	Assignment	External	1

Table 12. List of Unique Relationships With Assigned Values for Information Characteristics (Continued)

LABEL	RELATIONSHIP DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
R861.	EQUALS |A84(E1), (E50), V272|	2	Assignment	Both	1
R862.	EQUALS |A9(E98), V273|	1	Assignment	External	1
R863.	EQUALS |A3(E20), V274|	1	Assignment	External	1
R864.	EQUALS |A4(E275), V2|	2	Assignment	Internal	1
R865.	EQUALS |A3,OP1005, V275|	1	Assignment	Both	2
R866.	IMPLIES |R864, R865|	2	Implication	Both	4
R867.	EQUALS |A50,R48, V276|	3	Assignment	External	2
R868.	EQUALS |A3(E41), V26|	2	Assignment	Internal	1
R869.	IMPACTS |(E48), R868|	2	Impact	Both	2
R870.	IFTHEN:NO-IMPACT |R55, (E20), (E54)|	2	Impact	Both	2

C.5 List of Unique Operators and Information Characteristics

The list of unique operators and the assigned values for information characteristics are shown in Table 13.

Table 13. List of Unique Operators With Assigned Values for Information Characteristics

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP1	MEETING |(E18), (E19), (E20)|	1	Communicates	External	1
OP2	SUPPORT |(E22), (E21)|	1	Alters	External	1
OP3	PUBLISHED |(E23), (E24)|	3	Alters	External	1
OP4	INFORMS |(E25), (E1), (E26)|	2	Informs	Internal	1
OP5	SEIZED |(E28), (E29)|	3	Alters	External	1
OP6	SECURED |(E28), A14(E29)|	3	Alters	External	1
OP7	PUBLISHED |(E23), (E30)|	3	Alters	Both	1
OP8	STOPPED |(E32), (E33)|	2	Alters	External	1
OP9	RETURNEDFROM |(E1), (E35)|	2	Alters	Both	1
OP10	INFORMS |(E36), (E1), (E37)|	2	Informs	External	1
OP11	EXPRESSEDDISPLEASURE |(E38), (E1)|	2	Informs	Both	1
OP12	DISAGREE |(E1), (E40), A4(E41)|	2	Alters	Both	1
OP13	SHUTDOWN |(E42), (E41)|	2	Alters	Both	1
OP14	SUPPORT |(E43), (E44)|	1	Alters	External	1
OP15	WILLTESTIFY |(E1), (E45), (E46)|	2	Informs	Both	1
OP16	INFORMS |(E36), (E1), OP15|	2	Informs	Both	2
OP17	CREATE |(E42), (E48)|	1	Alters	External	1
OP18	INTENDS |OP17|	1	Alters	External	2
OP19	PUBLISHED |(E49), (E50)|	3	Alters	Both	1
OP20	SUSPECTS |(E36), R53|	2	Believes	External	2
OP22	PREPARE |(E59)|	1	Prepares	Internal	1
OP23	DIRECTS |(E1), (E58), OP22|	2	Directs	Internal	2
OP24	INFORMS |(E36), (E1), A1(E24)|	2	Informs	Both	1
OP25	ANSWER |(E58), (E62), A1(E24)|	2	Informs	Both	1
OP26	INFORMS |(E58), (E63) AND (E64), A1(E24)|	2	Informs	Both	1
OP27	INQUIRES |(E1), (E36), A21(E26)|	2	Inquires	Both	1
OP28	INQUIRES |(E1), (E36), A22(E26)|	2	Inquires	Both	1
OP29	INQUIRES |(E1), (E36), A23(E26)|	2	Inquires	Both	1
OP30	INQUIRES |(E1), (E36), A24(E26)|	2	Inquires	Both	1
OP31	INQUIRES |(E1), (E36), R64|	2	Inquires	Both	2
OP32	IFTHEN:INQUIRES |R30, (E1), (E67), A26(E68)|	2	Inquires	Both	2
OP33	IFTHEN:INQUIRES |R30, (E1), (E67), A18(E68)|	2	Inquires	Both	2
OP34	IFTHEN:INQUIRES |R30, (E1), (E67), A24(E68)|	2	Inquires	Both	2
OP35	INQUIRES |(E1), (E38), R69|	3	Inquires	Both	2
OP36	INQUIRES |(E1), (E36), A27(E8)|	4	Inquires	Both	1
OP37	INQUIRES |(E1), (E36), A28(E8)|	4	Inquires	Both	1
OP38	CONSIDERS |(E1), (E30)|	2	Evaluates	External	1
OP39	DETERMINE |(E70), A1(E31), AND A24(E31)|	2	Decides	Both	1
OP40	DIRECTS |(E1), (E70), OP39|	2	Directs	Both	2
OP41	ANSWER |(E1), (E71)|	2	Informs	Internal	1
OP42	PREPARES |(E1), OP41|	2	Prepares	Internal	2
OP43	BRIEF |(E1), (E64), (E31)|	2	Informs	Both	1
OP44	PREPARE |(E1), OP43|	2	Prepares	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP45	BRIEF |(E1), (E72), (E31)|	2	Informs	Both	1
OP46	PREPARE |(E1), OP45|	2	Prepares	Both	2
OP47	PREPARE |(E1), (E73)|	2	Prepares	External	1
OP48	DIRECTS |(E1), (E58), OP47|	2	Directs	Both	2
OP49	INQUIRES |(E1), (E74), A29,OP8|	2	Inquires	Both	2
OP50	DOESNOTHANDLE |(E1), OP8|	2	Alters	Both	2
OP51	REFERSTO |(E1), (E74), AND (E38), AND (E75),	2	Informs	Both	2
OP52	CRISIS |(E1), (E34)|	3	Alters	Internal	1
OP53	INQUIRES |(E1), (E36), A1(E34)|	3	Inquires	Both	1
OP54	INQUIRES |(E1), (E36), A6(E34)|	3	Inquires	Both	1
OP55	INQUIRES |(E1), (E36), A30(E34)|	3	Inquires	Both	1
OP56	INQUIRES |(E1), (E36), A31(E34)|	3	Inquires	Both	1
OP57	BRIEF |(E1), (E36), A1(E34)|	3	Informs	Both	1
OP58	INQUIRES |(E1), (E36), A6,R72|	3	Inquires	Both	2
OP59	INQUIRES |(E1), (E36), A32,R72|	3	Inquires	Both	2
OP60	INQUIRES |(E1), (E36), R75|	3	Inquires	Both	3
OP61	RESTART |(E79), (E6)|	3	Alters	Internal	1
OP62	PROVIDES |(E1), (E79), (E80), OP61|	3	Alters	Internal	2
OP63	CONSIDERS |(E1), R79|	2	Evaluates	External	2
OP64	INQUIRES |(E1), (E38), A1(E29)|	3	Inquires	Both	1
OP65	PROVIDES |(E1), (E81)|	4	Alters	Internal	1
OP66	BRIEF |(E1), (E38), A32(E6)|	3	Informs	Both	1
OP67	INFORMS |(E1), (E75), A32(E6)|	3	Informs	Both	1
OP68	RECEIVES |(E1), (E79), A1(E6)|	3	Inquires	Internal	1
OP69	WHEN |OP68, OP62|	3	Provides	Internal	4
OP70	FIXING |(E85), (E34)|	3	Alters	Both	1
OP71	ADDRESSES |(E74), AND (E75), OP8|	2	Communicates	External	2
OP72	DECIDES |(E1), (E87)|	2	Decides	External	1
OP73	RECEIVES |(E1), (E86)|	2	Inquires	Both	1
OP74	WHEN |OP73, OP72|	2	Provides	Both	3
OP75	WAIT |(E1), R89|	2	Alters	Both	2
OP76	MADE |(E88), (E89)|	1	Alters	External	1
OP77	RESIGNS |(E1)|	2	Alters	Internal	1
OP78	INFORMS |(E1), (E58), A1(E92)|	2	Informs	Both	1
OP79	INFORMS |(E1), (E58), A6,OP13|	2	Informs	Both	2
OP80	PREPAREFOR |(E58), (E92)|	2	Prepares	External	1
OP81	SUPPORT |(E1), (E44)|	2	Alters	Both	1
OP82	INQUIRES |(E1), A36,OP14|	2	Inquires	Both	2
OP83	INQUIRES |(E1), A37,OP14|	2	Inquires	Both	2
OP84	INQUIRES |(E1), A38,OP14|	2	Inquires	Both	2
OP85	SUPPORTS |(E1), OP14|	2	Alters	Both	2
OP86	INFORMS |(E1), (E93), OP14|	3	Informs	Both	2
OP87	INQUIRES |(E1), (E36), A1,OP13|	2	Inquires	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP88	PREPARES |(E1), (E94)|	2	Prepares	Both	1
OP89	INFORMS |(E1), (E45), A39(E92)|	2	Informs	External	1
OP90	IFTHEN:INFORM |R92, (E1), (E45), A6,OP13|	2	Informs	Both	3
OP91	PREPARE |(E1), (E58), (E92)|	2	Prepares	Both	1
OP92	INQUIRES |(E1), (E36), A27,R48|	3	Inquires	Both	2
OP93	INQUIRES |(E1), (E36), A40(E47)|	3	Inquires	Both	1
OP94	INQUIRES |(E1), (E36), A1(E47)|	3	Inquires	Both	1
OP95	VALIDATES |(E1), R48|	3	Alters	Both	2
OP96	INQUIRES |(E1), (E36), R93|	3	Inquires	Both	3
OP97	INQUIRES |(E1), (E96)|	3	Inquires	Both	1
OP98	INFORMS |(E1), (E58), A1(E48)|	2	Informs	Both	1
OP99	INFORMS |(E1), (E58), A32(E41)|	2	Informs	Internal	1
OP100	IFTHEN:ACCELERATE |R99, (E98)|	1	Alters	External	2
OP101	IFTHEN:SPECIALCASE |R100, (E98)|	1	Alters	External	2
OP102	INQUIRES |(E1), (E36), A1(E98)|	2	Inquires	Both	1
OP103	IFTHEN:ACTS |OP102, (E98)|	2	Alters	Both	2
OP104	BRIEFS |(E36), (E1), (E51)|	2	Informs	Both	1
OP105	INQUIRES |(E1), (E36), R111|	2	Inquires	Both	2
OP106	RUN |(E1), (E49), (E51)|	3	Alters	Both	1
OP107	INQUIRES |(E1), (E36), A46,R119|	2	Inquires	Both	3
OP108	INQUIRES |(E1), (E36), A1(E51)|	2	Inquires	Both	1
OP109	CUT |(E36), (E101)|	2	Alters	External	1
OP110	INQUIRES |(E1), (E36), R127|	2	Inquires	Both	3
OP111	CONSIDERS |(E1), (E24)|	2	Evaluates	Both	1
OP112	INQUIRES |(E1), (E29), A27(E69)|	3	Inquires	Both	1
OP113	INQUIRES |(E1), (E29), A49(E69)|	3	Inquires	Both	1
OP114	INQUIRES |(E1), (E29), R137|	3	Inquires	Both	2
OP115	INQUIRES |(E1), (E29), A1,R138|	3	Inquires	Both	2
OP116	UNDERSTAND |(E1), A1,R138|	3	Knows	Both	2
OP117	NEEDS |(E1), OP116|	3	Needs	Both	3
OP118	INQUIRES |(E1), (E58), A1,R144|	3	Inquires	Both	2
OP119	INQUIRES |(E1), (E36), A6(E26)|	2	Inquires	Both	1
OP120	INQUIRES |(E1), (E36), A51(E26)|	2	Inquires	Both	1
OP121	INQUIRES |(E1), (E36), R147|	2	Inquires	Both	2
OP122	INQUIRES |(E1), (E36), R148|	2	Inquires	Both	2
OP123	ASSESS |(E36), (E26)|	2	Evaluates	Both	1
OP124	DIRECTS |(E1), (E36), OP123|	2	Directs	Both	2
OP125	KILL |(E36), (E19)|	1	Alters	External	1
OP126	PROTECT |(E1), A4(E106)|	2	Alters	Internal	1
OP127	UNDERSTAND |(E1), A1(E26)|	2	Knows	Internal	1
OP128	PROVIDES |(E1), (E55)|	2	Alters	Both	1
OP129	PROVIDE |(E58), (E108)|	2	Alters	Internal	1
OP130	DIRECTS |(E1), (E58), OP129|	2	Directs	Internal	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP131	FINDS |(E36), (E111)|	3	Inquires	Both	1
OP132	FINDS |(E36), (E109)|	3	Inquires	Both	1
OP133	INQUIRES |(E1), (E36), A18(E68)|	2	Inquires	Both	1
OP134	INQUIRES |(E1), (E36), A26(E68)|	2	Inquires	Both	1
OP135	DETERMINE |(E58), R162|	2	Decides	Both	2
OP136	WORKWITH |(E58), (E114), OP135|	2	Communicates	Both	3
OP137	DIRECTS |(E1), (E58), OP136|	2	Directs	Both	4
OP138	PREPARE |(E58), R163|	2	Prepares	Both	2
OP139	DIRECTS |(E1), (E115), OP138|	3	Directs	Both	3
OP140	INQUIRES |(E1), (E115), R164|	3	Inquires	Both	2
OP141	INQUIRES |(E1), (E36), R167|	2	Inquires	Both	3
OP142	UNDERSTAND |(E1), A45(E118)|	2	Knows	Both	1
OP143	MAINTAINSCONTACT |(E1), (E38), A4(E29)|	3	Communicates	Both	1
OP144	INQUIRES |(E1), (E58), R172|	3	Inquires	Both	2
OP145	INQUIRES |(E1), (E58), R173|	3	Inquires	Both	2
OP146	INQUIRES |(E1), (E58), R174|	3	Inquires	Both	2
OP147	INQUIRES |(E1), (E58), A3,R174|	3	Inquires	Both	2
OP148	INQUIRES |(E1), (E58), A1,R175|	3	Inquires	Both	2
OP149	INQUIRES |(E1), (E58), R83|	3	Inquires	Both	2
OP150	INQUIRES |(E1), (E58), A1(E29)|	3	Inquires	Both	1
OP151	STOPSHIPMENTS |(E1), (E79), (E29), (E119), AND	3	Alters	Both	1
OP152	STOPSHIPMENTS |(E38), (E29), (E79), (E121)|	3	Alters	Both	1
OP153	UNDERSTAND |(E1), A1, R175|	3	Knows	Both	2
OP154	INQUIRES |(E1), A1(E29)|	3	Inquires	Both	1
OP155	INQUIRES |(E1), A1, R175|	3	Inquires	Both	2
OP156	UNDERSTAND |(E1), A1,R34|	4	Knows	Internal	2
OP157	INQUIRES |(E1), (E36), R178|	4	Inquires	Both	3
OP158	INQUIRES |(E1), (E36), A27,R34|	4	Inquires	Both	2
OP159	INQUIRES |(E1), (E36), A32(E8)|	4	Inquires	Both	1
OP160	INQUIRES |(E1), (E36), R179|	4	Inquires	Both	3
OP161	INQUIRES |(E1), (E36), R180|	4	Inquires	Both	3
OP162	SUMOF |A43(E9), A43(E7)|	4	Alters	Internal	1
OP163	INQUIRES |(E1), (E36), A1(E30)|	2	Inquires	External	1
OP164	REVIEW |(E122), (E31)|	3	Inquires	Internal	1
OP165	DIRECTS |(E1), (E122), OP164|	3	Directs	Internal	2
OP166	REQUESTSCOPY |(E1), (E36), (E123)|	2	Inquires	Both	1
OP167	WORKSWITH |(E1), (E58)|	2	Communicates	Internal	1
OP168	VALIDATES |(E1), A15(E31)|	2	Alters	Internal	1
OP169	INQUIRES |(E1), (E36), A53(E123)|	2	Inquires	Both	1
OP170	DAMAGECONTROL |(E1), OP7|	3	Alters	External	2
OP171	REQUESTSASSISTANCE |(E1), (E124)|	2	Alters	Both	1
OP172	REQUESTSASSISTANCE |(E1), (E125), (E31)|	2	Alters	Both	1
OP173	SHIPPING |(E126), (E128), (E129)|	3	Alters	Both	1

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP174	STOPPED |(E32), OP173|	3	Alters	Both	2
OP175	PROVIDES |(E1), (E38), (E129)|	3	Alters	Both	1
OP176	SHIPPING |(E1), (E38), (E129)|	3	Alters	Both	1
OP177	STOPPED |(E32), OP176|	3	Alters	Both	2
OP178	PRESHIPPED |(E126), (E85), (E129)|	3	Alters	Both	1
OP179	SHIPPING |(E126), (E85), (E129)|	3	Alters	Both	1
OP180	STOPPED |(E32), OP179|	3	Alters	Both	2
OP181	PROVIDE |(E131), (E130), (E129)|	5	Alters	Both	1
OP182	SOLICITING |(E130), (E131), OP181|	5	Alters	Both	2
OP183	REACTION |(E1), OP8, V70|	2	Alters	Both	2
OP184	PROVIDE |(E131), (E132), (E129)|	5	Alters	Both	1
OP185	SOLICITING |(E130), (E131), OP184|	5	Alters	Both	2
OP186	WORKSWITH |(E1), (E38), OP185|	5	Communicates	Both	3
OP187	INQUIRES |(E1), (E36), A9(E34)|	3	Inquires	Both	1
OP188	INQUIRES |(E1), (E36), A56(E34)|	3	Inquires	Both	1
OP189	INQUIRES |(E1), (E36), A57(E34)|	3	Inquires	Both	1
OP190	INQUIRES |(E1), (E36), R205|	3	Inquires	Both	2
OP191	INQUIRES |(E1), (E36), R206|	3	Inquires	Both	2
OP192	UNDERSTAND |(E1), A58,R50|	2	Knows	Internal	2
OP193	PROVIDE |(E1), (E137), (E138)|	2	Alters	Both	1
OP194	PROVIDE |(E1), (E137), A59,R208|	2	Alters	Both	2
OP195	PROVIDE |(E1), (E137), A59,R209|	2	Alters	Both	2
OP196	UPGRADING |(E1), (E139)|	2	Alters	Internal	1
OP197	PROVIDE |(E1), (E137), A59,OP196|	2	Alters	Both	2
OP198	PROVIDE |(E1), (E137), A59(E54)|	2	Alters	Both	1
OP200	ACTION |(E1), (E140)|	2	Alters	Internal	1
OP201	REACTION |(E1), (E37), V70|	2	Alters	External	1
OP202	INQUIRES |(E1), (E141), A1(E37)|	2	Inquires	Both	1
OP203	INQUIRES |(E1), (E141), A6(E37)|	2	Inquires	Both	1
OP204	INQUIRES |(E1), (E141), A61(E37)|	2	Inquires	Both	1
OP205	DOESNOTINQUIRE |(E1), (E141), A1(E37)|	2	Inquires	Both	1
OP206	DECIDES |(E1),(E87)|	2	Decides	External	1
OP207	CHANGEJOBS |(E1)|	2	Alters	Internal	1
OP208	IDENTIFIED |(E1), (E145)|	2	Decides	Internal	1
OP209	EVALUATES |(E1), (E143)|	2	Evaluates	Both	1
OP210	CONSIDERS |(E1), (E54)|	2	Evaluates	Internal	1
OP211	INFORMS |(E1), (E49), A1,OP8|	3	Informs	Both	2
OP212	DETERMINES |(E49), R223|	3	Decides	Both	3
OP213	INQUIRES |(E1), (E49), A1, R223|	3	Inquires	Both	3
OP214	INQUIRES |(E1), (E49), A65(E146)|	3	Inquires	Both	1
OP215	INQUIRES |(E1), (E49), R225|	3	Inquires	Both	2
OP216	INQUIRES |(E1), (E49), R226|	3	Inquires	Both	2
OP217	INQUIRES |(E1), (E49), R227|	3	Inquires	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP218	SHIFTRESOURCES |(E1)|	2	Alters	Internal	1
OP219	INQUIRES |(E1), (E49), OP218|	3	Inquires	Internal	2
OP220	INQUIRES |(E1), (E49), A66(E126)|	3	Inquires	Internal	1
OP221	INFORMS |(E36), (E1), A1(E34)|	3	Informs	Both	1
OP222	UNDERSTAND |(E1), A9(E34)|	3	Knows	Internal	1
OP223	UNDERSTAND |(E1), A1(E34)|	3	Knows	Internal	1
OP224	INQUIRES |(E1), (E36), R231|	3	Inquires	Both	2
OP225	INQUIRES |(E1), (E49), A1(E34)|	3	Inquires	Internal	1
OP226	CONSIDERS |(E1), (E37)|	2	Evaluates	External	1
OP227	CHANGES |(E18), (E152)|	2	Alters	External	1
OP228	CONSIDERS |(E1), OP227|	2	Evaluates	Both	2
OP229	SUPPORT |(E18), (E153)|	1	Alters	Both	1
OP230	MONITORS |(E1), (E92)|	2	Inquires	External	1
OP231	MINIMIZE |(E1), R243,|	2	Alters	Both	4
OP232	INQUIRES |(E1), (E36), A58,OP13|	2	Inquires	Both	2
OP233	WANTS |(E42), R246|	1	Wants	Both	2
OP234	INQUIRES |(E1), (E36), OP233|	2	Inquires	External	3
OP235	WANTS |(E40), R246|	1	Wants	Both	2
OP236	INQUIRES |(E1), (E36), OP235|	2	Inquires	External	3
OP237	INQUIRES |(E1), (E36), R247|	2	Inquires	Both	2
OP238	EVALUATE |(E58), A1(E92)|	2	Evaluates	External	1
OP239	DIRECTS |(E1), (E58), OP238|	2	Directs	Both	2
OP240	INQUIRES |(E1), (E58), A1(E92)|	2	Inquires	Both	1
OP241	KNOWS |(E1), A1(E92)|	2	Knows	External	1
OP242	INQUIRES |(E1), (E58), A32(E41)|	2	Inquires	Internal	1
OP243	NEEDS |(E1), R253|	2	Needs	Internal	3
OP244	NEEDS |(E1), OP238|	2	Needs	Both	2
OP245	INQUIRES |(E1), (E79), A4,R50|	2	Inquires	Internal	2
OP246	INQUIRES |(E1), (E40), A1(E92)|	2	Inquires	External	1
OP247	PREPARES |(E1), A31(E159)|	2	Prepares	External	1
OP248	PREPARES |(E1), A32(E41)|	2	Prepares	Internal	1
OP249	PREPARE |(E115), R255|	3	Prepares	Both	3
OP250	DIRECTS |(E1), (E115), OP249|	3	Directs	Both	4
OP251	PREPARE |(E115), R256|	3	Prepares	Both	3
OP252	DIRECTS |(E1), (E115), OP251|	3	Directs	Both	4
OP253	INFORMS |(E1), (E45), A1(E116)|	2	Informs	Both	1
OP254	EXECUTING |(E160)|	2	Alters	Both	1
OP255	RESTARTING |(E41)|	2	Alters	Internal	1
OP256	INQUIRES |(E1), (E36), R263|	2	Inquires	Both	4
OP257	EVALUATE |(E36), A1(E92)|	1	Evaluates	Both	1
OP258	WILLTESTIFY |(E1), (E45)|	2	Informs	Both	1
OP259	NEEDS |(E1), R264|	2	Needs	Both	4
OP260	INFORMS |(E1), (E45), A1(E92)|	2	Informs	External	1

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP261	INFORMS |(E1), (E45), A3(E92)|	2	Informs	External	1
OP262	EVALUATE |(E115), R266|	3	Evaluates	Both	2
OP263	RESTART |(E41)|	2	Alters	Internal	1
OP264	INQUIRES |(E1), (E36), R282|	3	Inquires	Both	2
OP265	INQUIRES |(E1), (E36), R283|	3	Inquires	Both	2
OP266	EVALUATE |(E58), R281|	3	Evaluates	Both	2
OP267	NEEDS |(E1), OP266|	3	Needs	Both	3
OP268	MONITOR |(E58), A4(E47)|	3	Inquires	Both	1
OP269	DIRECTS |(E1), (E58), OP268|	3	Directs	Both	2
OP270	KNOW |R281|	3	Knows	Both	2
OP271	NEEDS |(E1), OP270|	3	Needs	Both	3
OP272	MONITOR |(E1), R292|	3	Inquires	Both	2
OP273	ESTABLISHESCONTACT |(E1), (E38), OP272|	3	Communicates	Both	3
OP274	INQUIRES |(E1), (E36), R294|	3	Inquires	Both	3
OP275	EVALUATE |(E1), (E161)|	3	Evaluates	Both	1
OP276	WORKSWITH |(E1), (E165), OP275|	3	Communicates	Both	2
OP277	EVALUATE |(E38), (E161)|	3	Evaluates	External	1
OP278	WORKSWITH |(E38), (E165), OP277|	3	Communicates	External	2
OP279	PREPARE |(E165), A30,R48|	3	Prepares	External	2
OP280	WORKSWITH |(E38), (E165), OP279|	3	Communicates	External	3
OP281	UNDERSTAND |(E1), A1(E92)|	2	Knows	External	1
OP282	UNDERSTAND |(E1), A1,R254|	2	Knows	Both	2
OP283	APPROVES |(E48), OP263|	2	Decides	Both	2
OP284	REVIEWS/APPROVES |(E48), OP254|	2	Decides	Both	2
OP285	ENSURE |R301|	1	Alters	Both	2
OP286	WORKSWITH |(E1), (E75), OP285|	2	Communicates	Both	3
OP287	MONITORS |(E1), A1(E48)|	2	Inquires	Both	1
OP288	ENSURE |(E1), R302|	2	Alters	Both	2
OP289	INQUIRES |(E1), (E36), R254|	2	Inquires	Both	2
OP290	INQUIRES |(E1), (E115), R303|	3	Inquires	Both	3
OP291	INQUIRES |(E1), (E115), R305|	3	Inquires	Both	3
OP292	INQUIRES |(E1), (E115), R307|	3	Inquires	Both	3
OP293	INTERESTIN |(E1), (E50), V103|	2	Inquires	Both	1
OP294	WOULDNOTSOLVE |(E98), (E167)|	3	Alters	Both	1
OP295	EVALUATE |(E50)|	1	Evaluates	External	1
OP296	IFTHEN:DIRECTS |R310, (E1), (E58), OP295|	2	Directs	Both	3
OP297	IFTHEN:INQUIRES |R310, (E1), (E36), A39(E98)|	2	Inquires	Both	2
OP298	INQUIRES |(E1), (E36), A40(E98)|	2	Inquires	Both	1
OP299	INQUIRES |(E1), (E36), R311|	2	Inquires	Both	2
OP300	PREPARES |(E36), R312|	2	Prepares	External	2
OP301	INQUIRES |(E1), (E36), A43(E98)|	2	Inquires	Both	1
OP302	INQUIRES |(E1), (E36), R313|	3	Inquires	Both	2
OP303	WANT |(E36), R314|	1	Wants	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP304	INQUIRES |(E1), (E36), A72(E98)|	2	Inquires	Both	1
OP305	INQUIRES |(E1), (E36), A71(E98)|	2	Inquires	Both	1
OP306	IFTHEN:SEEK |R315, A71(E98)|	1	Inquires	External	2
OP307	PROVIDES |(E1), R317|	2	Alters	Both	2
OP308	INQUIRES |(E1), (E36), A1(E50)|	2	Inquires	Both	1
OP309	INQUIRES |(E1), (E36), A1,R319|	2	Inquires	Both	2
OP310	INQUIRES |(E1), (E36), R321|	2	Inquires	Both	3
OP311	PREPARE |(E51)|	2	Prepares	External	1
OP312	PARTICIPATEIN |(E58), OP311|	2	Alters	Both	2
OP313	SUPPORT |(E58), R52|	2	Alters	Both	2
OP314	INQUIRES |(E1), (E36), OP313|	2	Inquires	Both	3
OP315	PREPARES |(E58), R330|	2	Prepares	Both	2
OP316	PROVIDES |(E1), (E172), (E116)|	2	Alters	Both	1
OP317	CONSIDERS |(E1), (E51)|	2	Evaluates	Both	1
OP318	COMPARES |(E1), (E51), (E17)|	2	Evaluates	Both	1
OP319	COMPARES |(E1), (E116), (E117)|	2	Evaluates	Both	1
OP320	IFTHEN:NEEDS |R238, (E1), R241|	2	Needs	Both	3
OP321	NEEDS |(E1), R334|	2	Needs	Internal	3
OP322	REDUCING |A5(E173)|	2	Alters	Internal	1
OP323	RESOLVING |R238|	2	Alters	External	2
OP324	CONSIDERS |(E1), OP323|	2	Evaluates	Both	3
OP325	INQUIRES |(E1), (E36), R341|	3	Inquires	Both	3
OP326	RESOLVES |(E1), R12|	4	Alters	Internal	2
OP327	IFTHEN:WANTS |(E26), OP109|	2	Wants	Both	2
OP328	REDUCING |(E83)|	2	Alters	Internal	1
OP329	REDUCE |(E84)|	2	Alters	External	1
OP330	INQUIRES |(E1), (E36), A1(E26)|	2	Inquires	Both	1
OP331	INQUIRES |(E1), (E36), R366|	2	Inquires	Both	2
OP332	INQUIRES |(E1), (E36), R367|	2	Inquires	Both	2
OP333	INQUIRES |(E1), (E36), A3(E26)|	2	Inquires	Both	1
OP334	INQUIRES |(E1), (E36), A32(E26)|	2	Inquires	Both	1
OP335	RECEIVES |(E1), A1(E26)|	2	Inquires	Internal	1
OP336	DECIDES |(E1), (E175), (E26)|	2	Decides	Both	1
OP337	INFORMS |(E1), (E72), A1(E26)|	2	Informs	Both	1
OP338	DOESNOTINFORM |(E1), (E63), A1(E26)|	2	Informs	Both	1
OP339	RELEASED |(E36), (E176), A1(E26)|	2	Alters	Both	1
OP340	IFTHEN:INFORMS |OP339, (E1), (E63), A1(E26)|	2	Informs	Both	2
OP341	INFORMS |(E58), (E137), A1(E26)|	2	Informs	Both	1
OP342	IFTHEN:WAITBEFORE |R369, OR R370, A1(E26),	2	Alters	Both	4
OP343	INFORMS |(E58), (E63), A1(E26)|	2	Informs	Both	1
OP344	INFORMS |(E58), (E177), A1(E26)|	2	Informs	Both	1
OP345	INFORMS |(E58), (E178), A1(E26)|	2	Informs	Both	1
OP346	IFTHEN:INFORMS |R371, (E58), (E179), A1(E26)|	2	Informs	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP347	INQUIRES |(E1), (E36), R372|	2	Inquires	Both	2
OP348	DETERMINES |(E1), A9(E176)|	2	Decides	Both	1
OP349	IFTHEN:INVESTIGATES |R378, (E1), (E26)|	2	Inquires	Internal	2
OP350	RESART |(E26)|	2	Alters	Internal	1
OP351	UNDERSTAND |(E1), A6(E26)|	2	Knows	Internal	1
OP352	RESTART |(E26)|	2	Alters	Internal	1
OP353	IFTHEN:DETERMINES |R383, AND R382, A3(	2	Decides	Internal	4
OP354	DETERMINES |(E1), R384|	2	Decides	Internal	2
OP355	CREATES |(E1), R386|	2	Alters	Both	3
OP356	UNDERSTAND |(E1), (E180)|	2	Knows	Both	1
OP357	EVALUATES |(E1), R387|	2	Evaluates	Both	2
OP358	INQUIRES |(E1), (E36), R387|	2	Inquires	Both	2
OP359	CONSIDERS |(E1), R397|	2	Evaluates	Both	2
OP360	CONSIDERS |(E1), (E21)|	2	Evaluates	Both	1
OP361	REDUCING |(E63), (E102), V32|	2	Alters	Both	1
OP362	PREPARES |(E1), R404|	2	Prepares	External	2
OP363	INQUIRES |(E1), (E36), R411|	2	Inquires	Both	3
OP364	CONSIDERS |(E1), (E118)|	2	Evaluates	Both	1
OP365	CONSIDERS |(E1), R414|	3	Evaluates	Both	2
OP366	INQUIRES |(E1), (E36), R417|	3	Inquires	Both	4
OP367	INQUIRES |(E1), (E36), A4,R418|	2	Inquires	Both	2
OP368	INQUIRES |(E1), (E36), A43,R419|	4	Inquires	Both	2
OP369	INQUIRES |(E1), (E36), A43,R420|	4	Inquires	Both	2
OP370	CONSIDERS |(E1), (E185)|	2	Evaluates	External	1
OP371	DETERMINES |(E1), A39(E185)|	2	Decides	External	1
OP372	PROTECT |(E1), (E54), V140|	2	Alters	Internal	1
OP373	CUTS |(E63), (E102), V32|	2	Alters	Both	1
OP374	IFTHEN:FIND |R427, (E1), (E108)|	2	Inquires	Both	2
OP375	DETERMINE |(E188)|	3	Decides	External	1
OP376	WORKSWITH |(E1), (E177), OP375|	3	Communicates	Both	2
OP377	INFORMS |(E1), (E72), A1(E108)|	2	Informs	Both	1
OP378	PREPARES |(E1), (E116)|	2	Prepares	Both	1
OP379	INFORMS |(E1), (E72), (E116)|	2	Informs	Both	1
OP380	RECOMMENDS |(E1), (E72), A39(E54)|	2	Alters	Both	1
OP381	PROTECT |(E1), (E54)|	2	Alters	Internal	1
OP382	RECOMMENDS |(E1), (E72), A39,OP381|	2	Alters	Both	2
OP383	RECOMMENDS |(E1), (E72), A77(E185)|	2	Alters	External	1
OP384	FINDING |(E1), (E108)|	2	Inquires	Internal	1
OP385	MINIMIZESBY |(E1), R436, OP384|	2	Alters	Both	3
OP386	CHANGE |(E84)|	2	Alters	External	1
OP387	IFTHEN:WORKSWITH |R437, (E1), (E130),	2	Communicates	Both	3
OP388	BECAUSE:NEEDS |R439, (E1), R241|	2	Needs	Both	4
OP389	REDUCE |(E151), A18,R440, V146|	2	Alters	External	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP390	NEEDS I(E1), R8, AND R6I	4	Needs	Internal	3
OP391	BECAUSE:NEEDS IR444, AND R443, (E1), R442I	2	Needs	Internal	4
OP392	SHUTDOWN I(E28), (E29)I	3	Alters	External	1
OP393	DOESNOTBELIEVE I(E1), OP392I	3	Believes	Both	2
OP394	SHUTDOWN I(E130), (E29)I	3	Alters	External	1
OP395	SHUTDOWN I(E1), (E9), AND (E7)I	4	Alters	Internal	1
OP396	IFTHEN:DECIDES IR451, (E1), OP395I	4	Decides	Internal	3
OP397	INQUIRES I(E1), (E36), A6,R8, AND A6,R6I	4	Inquires	Both	3
OP398	DEALWITH I(E1), A80,R8, A80,R6, AND R451I	4	Alters	Internal	4
OP399	NOTSHUTDOWN I(E1), (E9), AND (E7)I	4	Alters	Internal	1
OP400	BECAUSE:NOTSHUTDOWN IOP3, OP399I	3	Alters	External	3
OP401	INQUIRES I(E1), (E36), A4(E31)I	2	Inquires	Both	1
OP402	INQUIRES I(E1), (E36), A81(E31)I	2	Inquires	Both	1
OP403	REQUESTSASSISTANCE I(E1), (E194), (E31)I	2	Alters	Both	1
OP404	DECIDES I(E1), R8, AND R6I	4	Decides	Internal	3
OP405	UPGRADES I(E31), R460I	2	Alters	Internal	2
OP406	INQUIRES I(E1), (E36), A3,OP405I	2	Inquires	Both	3
OP407	UPGRADES I(E31)I	2	Alters	Internal	1
OP408	DECIDES I(E1), R462I	2	Decides	Internal	5
OP409	IFTHEN:SHUTDOWN IR451, AND R465, (E1),	2	Alters	Internal	3
OP410	OPERATINGWITH I(E41), R451I	2	Alters	Internal	2
OP411	BALANCE I(E1), (E46), A77,OP410I	2	Alters	Internal	3
OP412	INQUIRES I(E1), (E36), A50(E31)I	2	Inquires	Both	1
OP413	IFTHEN:SHUTDOWN IR466, (E1), (E41)I	2	Alters	Internal	2
OP414	RESTART I(E1) (E41)I	2	Alters	Internal	1
OP415	DECIDES I(E1), OP414I	2	Decides	Internal	2
OP416	RESTART IR467I	1	Alters	External	2
OP417	CONTINUEOPERATINGWITH I(E195), (E196)I	1	Alters	External	1
OP418	INQUIRES I(E1), (E36), A1(E31)I	2	Inquires	Both	1
OP419	BECAUSE:REQUESTSASSISTANCE IR469, (E1),	2	Alters	Both	2
OP420	REQUESTSASSISTANCE I(E1), (E125), (E197),	2	Alters	Both	1
OP421	EVALUATE I(E31)I	2	Evaluates	Internal	1
OP422	GOTO I(E1), AND (E194), (E79), OP421I	2	Alters	Both	2
OP423	INQUIRES I(E1), (E79), A4(E31)I	2	Inquires	Internal	1
OP424	WORKSWITH I(E1), (E199), (E31)I	2	Communicates	Both	1
OP425	GOTO I(E1), AND (E199), (E79), OP421I	2	Alters	Both	2
OP426	DETERMINES I(E1), A3,R50I	2	Decides	Internal	2
OP427	REORGANIZES I(E42), (E130)I	1	Alters	External	1
OP428	INQUIRES I(E1), (E36), A26,R479I	2	Inquires	Both	2
OP429	DOESNOTKNOW:OTHERTHAN I(E1), A26,R479,	3	Knows	Both	2
OP430	DECIDING I(E1), (E87)I	2	Decides	External	1
OP431	CONSIDERS I(E1), OP430I	2	Evaluates	Both	2
OP432	DEALINGWITH I(E1), (E186)I	2	Alters	External	1

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP433	CONSIDERS I(E1), OP432I	2	Evaluates	Both	2
OP434	UNDERSTAND I(E1), A1(E116)I	2	Knows	Both	1
OP435	UNDERSTAND I(E1), A1(E185)I	2	Knows	External	1
OP436	DETERMINE I(E185)I	2	Decides	Both	1
OP437	WORKSWITH I(E1), (E58), OP436I	2	Communicates	Both	2
OP438	UNDERSTAND I(E1), A1(E186)I	2	Knows	External	1
OP439	ACQUIRE I(E1), A1(E186)I	2	Alters	External	1
OP440	DECIDES I(E1), OP8I	2	Decides	Both	2
OP441	SHUTDOWN I(E1), (E126)I	3	Alters	Internal	1
OP442	DECIDES I(E1), R485I	3	Decides	Internal	3
OP443	SHIPS I(E126), (E203)I	3	Alters	Internal	1
OP444	INQUIRES I(E1), (E36), A1,OP443I	3	Inquires	Both	2
OP445	INQUIRES I(E1), (E36), A66,OP443I	3	Inquires	Both	2
OP446	INQUIRES I(E1), (E36), A85,OP443I	3	Inquires	Both	2
OP447	SINCE:NOACT IR41, AND R486, (E1), (E34)I	3	Alters	Internal	3
OP448	DOESNOTNEED I(E1), (E129), (E126)I	3	Needs	Both	1
OP449	DETERMINES I(E1), A4(E126)I	3	Decides	Internal	1
OP450	CONFRONTS I(E1), (E32), (E127)I	2	Informs	Both	1
OP451	INQUIRES I(E1), (E36), A50(E127)I	2	Inquires	Both	1
OP452	STOPPED I(E207), A57(E29)I	3	Alters	External	1
OP453	IFTHEN:TALKWITH IOP452, (E1), (E208), A29,I	3	Communicates	Both	3
OP454	DECIDES I(E130), A9(E127)I	2	Decides	External	1
OP455	INFORMED I(E130), (E32), A29(E127)I	2	Informs	External	1
OP456	NOTOVERRIDE I(E130), (E32), (E127)I	2	Alters	External	1
OP457	DECIDED I(E130), OP456I	2	Decides	External	2
OP458	WORKWITH I(E130), (E32)I	1	Communicates	External	1
OP459	DECIDED I(E130), R498I	1	Decides	External	3
OP460	NOTGOTO I(E130), (E209)I	1	Alters	External	1
OP461	SHIP I(E130), (E202)I	1	Alters	External	1
OP462	STOP I(E32), OP461I	1	Alters	External	2
OP463	GOTO I(E32), (E209), OP462I	1	Alters	External	3
OP464	DEALSWITH I(E1), (E126)I	3	Alters	Internal	1
OP465	SHUTDOWN I(E126)I	3	Alters	Internal	1
OP466	DOESNOTWANT I(E1), OP465I	3	Wants	Internal	2
OP467	INQUIRES I(E1), (E36), A1(E126)I	3	Inquires	Both	1
OP468	EVALUATES I(E1), OP465I	3	Evaluates	Internal	2
OP469	INQUIRES I(E1), (E36), A87(E126)I	3	Inquires	Both	1
OP470	INQUIRES I(E1), (E36), A3,R50I	2	Inquires	Both	2
OP471	INQUIRES I(E1), (E36), A1,R330I	2	Inquires	Both	2
OP472	INQUIRES I(E1), (E36), A88,OP443I	3	Inquires	Both	2
OP473	PROVIDES I(E126), (E132), AND (E29), (E202)I	3	Alters	Both	1
OP474	INQUIRES I(E1), (E36), A3,R502I	4	Inquires	Both	2
OP475	WORKSWITH I(E1), (E38), OP8I	2	Communicates	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP476	WORKSWITH |(E1), (E38), OP465|	3	Communicates	Both	2
OP477	STOP |(E32), OP465|	3	Alters	Both	2
OP478	WORKSWITH |(E1), (E38), OP477|	3	Communicates	Both	3
OP479	DECIDES |(E1), R508|	2	Decides	Both	3
OP480	DECIDES |(E1), OP450|	2	Decides	Both	2
OP481	DELAY |OP480|	2	Alters	Both	3
OP482	DECIDES |(E1), OP481|	2	Decides	Both	4
OP483	WAITS |(E1), OP480|	2	Alters	Both	3
OP484	DOESNOTUNDERSTAND |(E38), A9,R50|	2	Knows	Both	2
OP485	DOESNOTBELIEVE |(E38), R512|	2	Believes	Both	2
OP486	EVALUATE |R50|	2	Evaluates	Internal	2
OP487	WORKSWITH |(E1), (E38), OP486|	2	Communicates	Both	3
OP488	SHUTDOWN |(E4), (E41)|	2	Alters	Internal	1
OP489	EVALUATES |(E4), R50|	2	Evaluates	Internal	2
OP490	EVALUATES |(E116)|	2	Evaluates	External	1
OP491	WORKSWITH |(E1), (E38), OP490|	2	Communicates	Both	2
OP492	EVALUATE |R514|	2	Evaluates	External	2
OP493	WORKSWITH |(E1), (E38), OP492|	2	Communicates	Both	3
OP494	BELIEVES |(E38), R515|	2	Believes	Both	2
OP495	RESTARTS |(E4), (E41), R516|	2	Alters	Internal	2
OP496	BELIEVES |(E38), R517|	2	Believes	Both	4
OP497	ATTACKS |(E1), A89(E126)|	3	Alters	Internal	1
OP498	ATTACKS |(E1), (E37), AND A76(E38)|	2	Alters	External	1
OP499	DECIDES |(E87)|	1	Decides	Both	1
OP500	CONSIDERS |(E1), OP499|	2	Evaluates	External	2
OP501	DIRECTS |(E1), (E58), (E87)|	2	Directs	Both	1
OP502	CONSIDERS |(E1), OP501|	2	Evaluates	Both	2
OP503	CONSIDERS |(E1), R518|	2	Evaluates	Both	2
OP504	CONSIDERS |(E1), R520|	2	Evaluates	Both	4
OP505	INQUIRES |(E1), (E36), A1(E116)|	2	Inquires	Both	1
OP506	INQUIRES |(E1), (E36), A11,R522|	2	Inquires	Both	4
OP507	INQUIRES |(E1), (E36), A1(E17)|	2	Inquires	Both	1
OP508	INQUIRES |(E1), (E36), R523|	2	Inquires	Both	2
OP509	NEEDS |(E1), R526|	2	Needs	Both	3
OP510	NEEDS |(E1), A91(E17)|	2	Needs	Both	1
OP511	NEEDS |(E1), A91,R529|	2	Needs	External	2
OP512	NEEDS |(E1), A91,R530|	2	Needs	External	2
OP513	NEEDS |(E1), A91,R532|	2	Needs	Both	2
OP514	NEEDS |(E1), A91,R533|	2	Needs	Both	3
OP515	INFORMS |(E1), (E45), A1(E186)|	2	Informs	External	1
OP516	DECIDES |(E1), OP515|	2	Decides	Both	2
OP517	INQUIRES |(E1), (E36), A92(E130)|	2	Inquires	Both	1
OP518	INFORMS |(E1), (E45), (E185)|	2	Informs	External	1

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP519	INQUIRES |(E1), (E36), R534|	2	Inquires	Both	4
OP520	ACCELERATE |(E130), A39(E44)|	1	Alters	External	1
OP521	INQUIRES |(E1), (E36), OP520|	2	Inquires	Both	2
OP522	NEEDS |(E1), A93,OP15|	2	Needs	Both	2
OP523	ATTENDS |(E214)|	1	Communicates	External	1
OP524	DECIDES |(E1), A36,OP523|	2	Decides	Both	2
OP525	ATTENDS |(E177), (E214)|	1	Communicates	External	1
OP526	ENCOURAGES |(E1), (E177), OP525|	2	Alters	Both	2
OP527	ASKS |(E45), (E177), OP525|	1	Inquires	External	2
OP528	NOTASKING |(E45), (E177), OP525|	1	Alters	External	2
OP529	IFTHEN:SUGGESTS |OP528, (E1), (E45), OP527|	2	Informs	Both	5
OP530	EVALUATES |(E186)|	1	Evaluates	Both	1
OP531	EVALUATES |R518|	1	Evaluates	External	2
OP532	PROVIDES |(E1), (E45), OP530|	2	Alters	External	2
OP533	PROVIDES |(E1), (E45), OP531|	2	Alters	Both	3
OP534	BECAUSE:WORKSWITH |R541, (E1), (E40), (E92)|	2	Communicates	Both	2
OP535	DIDNOTWANT |(E1), OP13|	2	Wants	Both	2
OP536	WANTED |(E40), OP13|	2	Wants	Both	2
OP537	UNDERSTAND |A84(E40)|	1	Knows	External	1
OP538	NEEDS |(E1), OP537|	2	Needs	Both	2
OP539	INFORMS |(E40), (E1), A1(E92)|	2	Informs	External	1
OP540	NEEDS |(E1), OP539|	2	Needs	Both	2
OP541	INFORMS |(E58), (E1), A1(E92)|	2	Informs	Both	1
OP542	NEEDS |(E1), OP541|	2	Needs	Both	2
OP543	RESOLVES |(E1), A6(E92)|	2	Alters	External	1
OP544	ADDRESSES |(E1), A95(E40)|	2	Communicates	Both	1
OP545	NEEDS |(E1), A39,OP544, AND A39,OP543|	2	Needs	Both	3
OP546	INQUIRES |(E1), (E36), A6(E92)|	2	Inquires	External	1
OP547	PROJECTS |(E1), R543|	2	Prepares	Both	3
OP548	INQUIRES |(E1), (E36), A96,R527|	2	Inquires	Both	3
OP549	INQUIRES |(E1), (E36), A39(E44)|	2	Inquires	Both	1
OP550	INQUIRES |(E1), (E36), A97,OP520|	2	Inquires	Both	2
OP551	INQUIRES |(E1), (E36), A72,OP520|	2	Inquires	Both	2
OP552	INQUIRES |(E1), (E36), A48,OP520|	2	Inquires	Both	2
OP553	INQUIRES |(E1), (E36), A11,OP520|	2	Inquires	Both	2
OP554	INTEGRATES |(E1), A1(E186)|	2	Alters	External	1
OP555	DECIDES |(E1), A93,OP15|	2	Decides	Both	2
OP556	DOESNOTPROVIDE |(E1), (E45), (E215)|	2	Alters	External	1
OP557	DEALSWITH |(E186)|	1	Alters	Both	1
OP558	DECIDES |(E1), OP557|	2	Decides	External	2
OP559	PROVIDES |(E1), (E45), A39,OP558|	2	Alters	Both	3
OP560	EVALUATES |(E1), (E186)|	2	Evaluates	External	1
OP561	PROVIDES |(E1), (E45), A39,OP560|	2	Alters	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP562	INFORMS I(E36), (E1), A1(E186)I	2	Informs	External	1
OP563	INFORMS I(E1), (E45), A11,OP562I	2	Informs	Both	2
OP564	PROVIDES I(E1), (E45), (E215)I	2	Alters	External	1
OP565	INFORMS I(E1), (E45), A11,OP564I	2	Informs	Both	2
OP566	INFORMS I(E1), (E45), R547I	2	Informs	External	3
OP567	INFORMS I(E1), (E45), R549I	2	Informs	External	5
OP568	INFORMS I(E1), (E45), R550I	2	Informs	Both	3
OP569	EVALUATES I(E1), A93(E54)I	2	Evaluates	Internal	1
OP570	CONSIDERS I(E1), R51I	2	Evaluates	Both	3
OP571	DEALSWITH I(E1), (E87)I	2	Alters	External	1
OP572	CONSIDERS I(E1), R553I	2	Evaluates	Both	3
OP573	DEALSWITH I(E1), (E186)I	2	Alters	External	1
OP574	INQUIRES I(E216), (E1), A39, OP573I	2	Inquires	Both	2
OP575	CONSIDERS I(E1), R556I	2	Evaluates	Internal	2
OP576	DETERMINES I(E1), R560I	2	Decides	Both	3
OP577	EVALUATES I(E1), R561I	2	Evaluates	Internal	3
OP578	DOESNOTKNOW I(E1), A50,OP13I	2	Knows	Both	2
OP579	PLANNING I(E87)I	1	Prepares	Both	1
OP580	DEALSWITH I(E47), (E217)I	3	Alters	External	1
OP581	EMPLOY I(E161)I	3	Alters	External	1
OP582	NEED I(E130), OP581I	3	Needs	External	2
OP583	EVALUATE I(E1), (E51)I	2	Evaluates	Both	1
OP584	NEEDS I(E1), OP583I	2	Needs	Both	2
OP585	DEALSWITH I(E98)I	1	Alters	External	1
OP586	DECIDES IOP585I	1	Decides	External	2
OP587	NEEDS I(E1), OP586I	2	Needs	Both	3
OP588	DOUBTS I(E1), A63(E50)I	2	Believes	Both	1
OP589	MAYNOTNEED I(E1), (E98)I	2	Needs	Both	1
OP590	DETERMINES I(E1), A100(E6), AND A101(E6)I	3	Decides	Internal	1
OP591	INQUIRES I(E1), (E36), A1(E83)I	2	Inquires	Both	1
OP592	INQUIRES I(E1), (E36), A1(E84)I	2	Inquires	Both	1
OP593	INQUIRES I(E1), (E36), A1(E52)I	2	Inquires	Both	1
OP594	INQUIRES I(E1), (E36), A96,R423I	2	Inquires	Both	2
OP595	INQUIRES I(E1), (E36), A9(E51)I	2	Inquires	Both	1
OP596	INQUIRES I(E1), (E36), R574I	2	Inquires	Both	2
OP597	INQUIRES I(E1), (E36), R576I	2	Inquires	Both	3
OP598	STARTUP I(E47)I	3	Alters	External	1
OP599	DISASSEMBLE I(E190)I	2	Alters	External	1
OP600	DEALSWITH I(E217)I	3	Alters	External	1
OP601	NEEDS I(E1), A93,OP600I	3	Needs	Both	2
OP602	IFTHEN:NEEDS IR581, (E1), A93(E161)I	3	Needs	Both	3
OP603	INQUIRES I(E1), (E36), R582I	3	Inquires	Both	2
OP604	DEALSWITH I(E1), (E50)I	2	Alters	Both	1

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP605	INQUIRES |(E36), (E1), A39,OP604|	2	Inquires	Both	2
OP606	NEEDS |(E1), (E218)|	4	Needs	Internal	1
OP607	DOESNOTDEALWITH |(E98), (E217)|	3	Alters	External	1
OP608	CREATES |(E98), (E217)|	3	Alters	External	1
OP609	CREATES |(E219), (E217)|	4	Alters	Both	1
OP610	PROVIDE |(E98), (E80)|	1	Alters	Both	1
OP611	DECIDES |(E1), OP610|	2	Decides	Both	2
OP612	MAYRECOVER |(E1), (E217)|	3	Alters	Both	1
OP613	INQUIRES |(E1), (E36), A6,OP13|	2	Inquires	Both	2
OP614	UNDERSTANDS |(E1), A6,OP13|	2	Knows	Both	2
OP615	PROJECTS |(E1), A3,R50|	2	Prepares	Internal	2
OP616	IFTHEN:NEEDS |R563, (E1), OP615|	2	Needs	Both	5
OP617	INFORMS |(E1), (E165), A39(E54)|	2	Informs	Both	1
OP618	INQUIRES |(E1), (E165), (E161)|	3	Inquires	Both	1
OP619	INFORMS |(E1), (E165), R577|	3	Informs	Both	2
OP620	INQUIRES |(E1), (E36), A33(E50)|	2	Inquires	Both	1
OP621	FUND |R592|	1	Alters	External	2
OP622	PRESSURES |(E36), (E1), OP621|	2	Alters	Both	3
OP623	INQUIRES |(E1), (E36), R593|	2	Inquires	Both	5
OP624	CONSIDERS |(E1), (E69)|	3	Evaluates	Both	1
OP625	INQUIRES |(E1), (E36), R594|	2	Inquires	Both	2
OP626	INQUIRES |(E1), (E36), R595|	2	Inquires	Both	2
OP627	IFTHEN:KNOWS |R594, (E1), A1(E26)|	2	Knows	Internal	2
OP628	IFTHEN:KNOWS |R594, (E1), A3(E26)|	2	Knows	Internal	2
OP629	MONITOR |(E49), A1(E220)|	3	Inquires	Internal	1
OP630	DIRECTS |(E1), (E49), OP629|	3	Directs	Internal	2
OP631	ENSURE |(E1), R596|	2	Alters	Internal	2
OP632	ENSURE |(E1), R598|	2	Alters	Internal	2
OP633	ENSURE |(E1), R601|	2	Alters	Internal	3
OP634	UNDERSTAND |(E49), A6(E26)|	3	Knows	Internal	1
OP635	DIRECTS |(E1), (E49), OP634|	3	Directs	Internal	2
OP636	DETERMINE |(E49), R603|	3	Decides	Internal	2
OP637	DIRECTS |(E1), (E49), OP636|	3	Directs	Internal	3
OP638	EVALUATES |(E49), R604|	3	Evaluates	Both	3
OP639	DIRECTS |(E1), (E49), OP638|	3	Directs	Both	4
OP640	EVALUATES |(E79), R603|	2	Evaluates	Internal	2
OP641	INQUIRES |(E1), (E49), OP640|	3	Inquires	Internal	3
OP642	IFTHEN:EVALUATES |R606, (E1), A39,OP352|	2	Evaluates	Internal	4
OP643	IFTHEN:FINDS |R609, (E1), (E108)|	2	Inquires	Internal	3
OP644	ACCELERATES |(E188)|	3	Alters	External	1
OP645	CONSIDERS |(E1), R612|	3	Evaluates	Both	3
OP646	ACCELERATES |R613, AND OP352|	2	Alters	External	3
OP647	CONSIDERS |(E1), A104,OP646|	2	Evaluates	Both	4

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP648	ENSURES |(E1), R615|	2	Alters	Both	3
OP649	SHUTDOWN |(E1), (E41)|	2	Alters	Internal	1
OP650	IFTHEN:CONSIDERS |R617, OP649|	2	Evaluates	Internal	4
OP651	SHUTDOWN |(E41)|	2	Alters	Internal	1
OP652	DECIDES |(E1), OP651|	2	Decides	Internal	2
OP653	DETERMINE |R620|	2	Decides	Internal	3
OP654	IFTHEN:WORKSWITH |OP652, (E1), (E224),	2	Communicates	Both	6
OP655	CONSIDERS |(E1), R27|	2	Evaluates	Both	3
OP656	BRIEFS |(E1), R621, (E56)|	2	Informs	Both	2
OP657	BRIEFS |(E1), (E226), (E56)|	2	Informs	Both	1
OP658	INFORM |(E1), (E226), R622|	2	Informs	Both	2
OP659	INFORM |(E1), (E226), R624|	2	Informs	Both	2
OP660	INFORM |(E1), (E226), R626|	2	Informs	Both	2
OP661	ESTABLISH |(E231)|	1	Alters	External	1
OP662	WORKSWITH |(E1), (E229), AND (E230), OP661|	2	Communicates	Both	2
OP663	PRESENT |(E1), (E226), A84(E1), (E56)|	2	Informs	Both	1
OP664	INFORMS |(E1), (E232), A1(E56), AND R629|	2	Informs	Both	2
OP665	IMPROVES |(E1), (E236), (E106)|	2	Alters	Internal	1
OP666	ESTABLISHES |(E1), OP665|	2	Alters	Internal	2
OP667	DOESNOTINFORM |(E36), (E1), (E234)|	2	Informs	Both	1
OP668	EVENTHOUGH:EVALUATES |R171, (E1), R640|	3	Evaluates	Both	3
OP669	REPORTS |(E237), (E69)|	3	Informs	External	1
OP670	CANNOTINFLUENCE |(E1), (E237), OP669|	3	Alters	Both	2
OP671	LEARNSFROM |(E1), (E69)|	3	Inquires	Both	1
OP672	IMPROVES |(E1), A106(E198), (E234)|	2	Alters	Internal	1
OP673	CONSIDERS |(E1), (E20)|	2	Evaluates	Both	1
OP674	MONITOR |(E20)|	1	Inquires	External	1
OP675	WORKWITH |(E115), (E224), OP674|	3	Communicates	Both	2
OP676	DIRECTS |(E1), (E115), OP675|	3	Directs	Both	3
OP677	EVALUATE |R642|	1	Evaluates	Both	2
OP678	DIRECTS |(E1), (E115), OP677|	3	Directs	Both	3
OP679	EVALUATE |R643|	2	Evaluates	External	2
OP680	DIRECTS |(E1), (E115), OP679|	3	Directs	Both	3
OP681	EVALUATES |(E1), R644|	2	Evaluates	Both	2
OP682	KNOWS |A55(E20)|	1	Knows	External	1
OP683	SHUTDOWN |(E106)|	1	Alters	Internal	1
OP684	DECIDES |(E1), OP683|	2	Decides	Internal	2
OP685	IFTHEN:DECIDESWITH |R645, AND OP684, (E1).	2	Decides	Both	6
OP686	DECIDESWITHOUT |(E1), OP683, OP682|	2	Decides	Both	3
OP687	DOESNOTWANT |(E1), OP686|	2	Wants	Both	4
OP688	DECIDES |(E1), A4(E106)|	2	Decides	Internal	1
OP689	IFTHEN:NEEDS |OP688, (E1), A1(E20)|	2	Needs	Both	2
OP690	CONSIDERS |(E1), R34|	4	Evaluates	Internal	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP691	CONSIDERS |OP3|	3	Evaluates	External	2
OP692	UNDERSTAND |(E49), A6,R34|	4	Knows	Internal	2
OP693	DIRECTS |(E1), (E49), OP692|	4	Directs	Internal	3
OP694	UNDERSTAND |(E49), A107(E30)|	3	Knows	External	1
OP695	DIRECTS |(E1), (E49), OP694|	3	Directs	Both	2
OP696	UNDERSTAND |(E49), A94(E30)|	3	Knows	External	1
OP697	DIRECTS |(E1), (E49), OP696|	3	Directs	Both	2
OP698	WANTS |(E1), OP692|	4	Wants	Internal	3
OP699	UNDERSTAND |(E49), A108,R34|	4	Knows	Internal	2
OP700	WANTS |(E1), OP699|	4	Wants	Internal	3
OP701	UNDERSTAND |(E49), A6,(E123)|	3	Knows	Internal	1
OP702	WANTS |(E1), OP701|	3	Wants	Internal	2
OP703	UNDERSTANDS |(E1), A6,R34|	4	Knows	Internal	2
OP704	WHEN:DETERMINES |OP703, (E1), R649|	4	Decides	Internal	4
OP705	SHUTDOWN |(E9), AND (E7)|	4	Alters	Internal	1
OP706	INQUIRES |(E1), R652|	4	Inquires	Internal	6
OP707	EVALUATES |(E1), OP651|	2	Evaluates	Internal	2
OP708	WHEN:DETERMINES |OP707, (E1), R654|	2	Decides	Both	6
OP709	IFTHEN:CONSIDERS |R656, (E1), A1(E54)|	4	Evaluates	Internal	4
OP710	INQUIRES |(E1), (E36), A45(E54)|	2	Inquires	Both	1
OP711	INQUIRES |(E1), (E36), A45(E31)|	2	Inquires	Both	1
OP712	INQUIRES |(E1), (E36), A45(E41)|	2	Inquires	Both	1
OP713	INQUIRES |(E1), (E36), R658|	2	Inquires	Both	3
OP714	CONSIDERS |(E1), R30|	2	Evaluates	Both	2
OP715	EVALUATE |R659|	2	Evaluates	Both	2
OP716	WORKWITH |(E49), (E224), AND (E177), OP715|	3	Communicates	Both	3
OP717	DIRECTS |(E1), (E49), OP716|	3	Directs	Both	4
OP718	INFORMS |(E1), (E42), R662|	4	Informs	Both	4
OP719	WANTS |(E1), R664|	2	Wants	Both	3
OP720	IFTHEN:INFORMS |R666, (E1), (E42), A1(E116)|	2	Informs	Both	3
OP721	RESTART:WITH |(E41), R667|	2	Alters	Internal	2
OP722	EVALUATES |(E1), A109,OP721|	2	Evaluates	Internal	3
OP723	CONSIDERS |(E1), OP5|	3	Evaluates	Both	2
OP724	MONITOR |R669|	3	Inquires	External	3
OP725	DIRECTS |(E1), (E49), OP724|	3	Directs	Both	4
OP726	MONITOR |R670|	3	Inquires	External	3
OP727	DIRECTS |(E1), (E49), OP726|	3	Directs	Both	4
OP728	BUILDS |(E190)|	2	Alters	External	1
OP729	UNDERSTAND |A6,OP5|	3	Knows	External	2
OP730	WANTS |(E1), OP729|	3	Wants	Both	3
OP731	UNDERSTAND |R675|	3	Knows	External	3
OP732	WANTS |(E1), OP731|	3	Wants	Both	4
OP733	IFTHEN:EMPLOYS |R676, (E1), (E221), (E106)|	2	Alters	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP734	CONSIDERS I(E1), R72I	3	Evaluates	Internal	2
OP735	DEVELOPS I(E1), A39(E6)I	3	Prepares	Internal	1
OP736	DEVELOPS IA110,R677I	3	Prepares	Internal	3
OP737	WORKSWITH I(E122), (E79), OP736I	3	Communicates	Internal	4
OP738	DIRECTS I(E1), (E122), OP737I	3	Directs	Internal	5
OP739	RESTARTS I(E6)I	3	Alters	Internal	1
OP740	UNDERSTANDS I(E38), A39,OP739I	3	Knows	Both	2
OP741	ENSURE I(E1), OP740I	3	Alters	Both	3
OP742	WORKSWITH I(E1), (E38), OP741I	3	Communicates	Both	4
OP743	PRODUCES I(E38), (E190)I	2	Alters	External	1
OP744	MINIMIZE IR678I	3	Alters	Both	4
OP745	WORKSWITH I(E1), (E38), OP744I	3	Communicates	Both	5
OP746	ACCELERATES I(E240)I	3	Alters	External	1
OP747	CONSIDERS I(E1), OP746I	3	Evaluates	Both	2
OP748	REDUCING IA111(E240)I	3	Alters	External	1
OP749	CONSIDERS I(E1), OP748I	3	Evaluates	Both	2
OP750	CONSIDERS I(E1), R680I	3	Evaluates	Both	3
OP751	MINIMIZE IR681, R678I	3	Alters	External	5
OP752	OWNS I(E1), A39,R682I	3	Alters	Internal	3
OP753	IMPART I(E241), A80(E38), (E54), AND OP752I	3	Alters	Both	4
OP754	CONSIDERS I(E1), OP8I	2	Evaluates	Both	2
OP755	DETERMINES I(E49), R685I	4	Decides	Both	2
OP756	DIRECTS I(E1), (E49), OP755I	4	Directs	Both	3
OP757	PRODUCES I(E126), (E242)I	3	Alters	Both	1
OP758	EVALUATES I(E49), (E54), AND (E110)I	4	Evaluates	Internal	1
OP759	DIRECTS I(E1), (E49), OP758I	4	Directs	Internal	2
OP760	MINIMIZE IR694I	4	Alters	Internal	4
OP761	UNDERSTANDS I(E58), A6(E127)I	2	Knows	Both	1
OP762	DIRECTS I(E1), (E58), OP761I	2	Directs	Both	2
OP763	INQUIRES I(E1), (E58), A65(E146)I	2	Inquires	Both	1
OP764	INQUIRES I(E1), (E58), R696I	2	Inquires	Both	2
OP765	UNDERSTANDS IA6(E127)I	2	Knows	External	1
OP766	WANTS I(E1), OP765I	2	Wants	Both	2
OP767	RESOLVES I(E1), (E245)I	2	Alters	Both	1
OP768	DEVELOPS IA39,OP767I	2	Prepares	Both	2
OP769	UNDERSTANDS I(E1), (E245)I	2	Knows	Both	1
OP770	MEETSWITH I(E1), (E246), OP769I	2	Communicates	Both	2
OP771	INFORMS I(E1), (E246), A39,OP767I	2	Informs	Both	2
OP772	SHIP I(E1), (E33)I	2	Alters	Both	1
OP773	WHEN:GETAGREEMENT IR698, (E1), (E246),	2	Decides	Both	5
OP774	UNDERSTANDS IA6(E34)I	3	Knows	Internal	1
OP775	WANTS I(E1), OP774I	3	Wants	Internal	2
OP776	INQUIRES I(E1), (E36), R701I	3	Inquires	Both	4

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP777	BECAUSE:REPLACED |R703, AND R702, (E247)|	3	Alters	Internal	3
OP778	EVALUATES |(E36), R700|	3	Evaluates	Both	2
OP779	DIRECTS |(E1), (E36), OP778|	3	Directs	Both	3
OP780	DOESNOTDECIDE |(E1), A17(E37)|	2	Decides	External	1
OP781	INQUIRES |(E49), (E1), A17(E37)|	3	Inquires	Both	1
OP782	IFTHEN:DOESNOTFEED |OP781, (E1), A17(E37)|	3	Alters	Both	2
OP783	KNOWS |(E1), A17(E37)|	2	Knows	External	1
OP784	IFTHEN:INFORMS |OP781, (E1), (E49), OP783|	3	Informs	Both	3
OP785	CONSIDER |(E248), (E249)|	1	Evaluates	External	1
OP786	DEVELOPS |(E122), A39,OP739|	3	Prepares	Internal	2
OP787	DIRECTS |(E1), (E122), OP786|	3	Directs	Internal	3
OP788	IMPLEMENTING |(E1), A39,OP739|	3	Alters	Internal	2
OP789	ENSURES |(E1), OP740|	3	Alters	Both	3
OP790	DIDNOTENUNCIATE |(E18), A45(E250)|	2	Informs	External	1
OP791	APPOINTED |(E18), (E42)|	1	Alters	External	1
OP792	CONSIDERS |(E1), OP791|	2	Evaluates	Both	2
OP793	CONDUCTS |(E4), (E92)|	1	Alters	External	1
OP794	BECAUSE:INFORMS |R710, (E49), R709|	3	Informs	Both	5
OP795	OPERATES |(E4), (E41)|	2	Alters	Internal	1
OP796	SATISFY |(E4), (E42), AND (E40), R711|	2	Alters	Both	3
OP797	SHUTSDOWN |(E36), (E251)|	1	Alters	Both	1
OP798	CONDUCTS |(E4), R714|	1	Alters	Both	2
OP799	BEFORE:CONDUCTS |OP797, OP798|	1	Alters	Both	4
OP800	DIRECTS |(E1), (E49), OP799|	3	Directs	Both	5
OP801	RESTARTS |(E1), (E41)|	2	Alters	Internal	1
OP802	BEFORE:RESOLVES |OP801, (E1), (E252)|	2	Alters	Both	2
OP803	INITIATES |(E1), (E92), AND A39,OP802|	2	Alters	Both	3
OP804	WORKSWITH |(E79), AND (E198), (E40), (E92)|	2	Communicates	Both	1
OP805	EMPHASIZES |(E1), (E79), AND (E198), OP804|	2	Alters	Both	2
OP806	ESTABLISHES |(E1), A39(E221)|	2	Alters	External	1
OP807	EMPHASIZES |(E1), (E79), AND (E198), R716|	2	Alters	Both	3
OP808	SOLVES |(E134)|	1	Alters	Both	1
OP809	WHEN:DEVELOPSANDSOLVES |R717, A39,	1	Alters	Both	3
OP810	DOESNOTWAIT:BEFORESOLVING |(E1), R718,	2	Alters	Both	2
OP811	CONSIDERS |(E1), OP14|	2	Evaluates	Both	2
OP812	NEEDS |(E254), (E44)|	1	Needs	Both	1
OP813	BECAUSEOF:SUPPORTS |R50, R444, AND OP812,.	2	Alters	Both	4
OP814	SUPPORTS |(E1), (E44)|	2	Alters	Both	1
OP815	CONSIDERS |(E1), OP15|	2	Evaluates	Both	2
OP816	EVALUATE |R719|	2	Evaluates	Both	2
OP817	DIRECTS |(E1), (E115), OP816|	3	Directs	Both	3
OP818	DETERMINE |(E49), (E185)|	3	Decides	External	1
OP819	DIRECTS |(E1), (E49), OP818|	3	Directs	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP820	DETERMINE |R720|	2	Decides	Both	3
OP821	WORKSWITH |(E1), (E224), OP820|	2	Communicates	Both	4
OP822	MINIMIZES |R720|	2	Alters	Both	3
OP823	DETERMINE |A97,OP822|	2	Decides	Both	4
OP824	WORKSWITH |(E1), (E224), OP823|	2	Communicates	Both	5
OP825	PREPARE |(E58), R721|	2	Prepares	Both	5
OP826	DIRECTS |(E1), (E58), OP825|	2	Directs	Both	6
OP827	BEFORE:OBTAINSAPPROVAL |OP15, (E1), (E72),	2	Decides	Both	2
OP828	PREPARES |(E58), (E268)|	2	Prepares	Internal	1
OP829	CONSIDERS |(E1), R48|	3	Evaluates	Both	2
OP830	DETERMINES |A4(E47)|	3	Decides	External	1
OP831	WORKSWITH |(E58), (E165), OP830|	3	Communicates	Both	2
OP832	DIRECTS |(E1), (E58), OP831|	3	Directs	Both	3
OP833	STARTSUP |(E47)|	3	Alters	External	1
OP834	DETERMINE |R727|	3	Decides	Both	4
OP835	WORKSWITH |(E58), (E165), OP834|	3	Communicates	Both	5
OP836	DIRECTS |(E1), (E58), OP835|	3	Directs	Both	6
OP837	DETERMINE |R729|	3	Decides	Both	5
OP838	WORKSWITH |(E58), (E165), OP837|	3	Communicates	Both	6
OP839	DIRECTS |(E1), (E58), OP838|	3	Directs	Both	7
OP840	CONSIDERS |(E1), R47|	2	Evaluates	Both	3
OP841	CONTINUES:UNTIL |(E1), (E54), R730|	2	Alters	Both	2
OP842	CONDUCTS |(E1), (E92)|	2	Alters	External	1
OP843	RESOLVES |A39(E221), R731|	1	Alters	Both	2
OP844	INITIATES |(E1), OP843|	2	Alters	Both	3
OP845	CONSIDERS |(E1), (E48)|	2	Evaluates	Both	1
OP846	SUPPORTS |(E1), R732|	3	Alters	Internal	2
OP847	SUPPORTS |(E1), (E257)|	3	Alters	Internal	1
OP848	PROVIDES |(E257), R733|	3	Alters	Internal	2
OP849	RECOMMENDS |(E1), R735|	3	Alters	Internal	2
OP850	PROVIDES |(E257), (E41), V236|	3	Alters	Internal	1
OP851	RECOMMENDS |(E1), R738|	3	Alters	Internal	4
OP852	CONSIDERS |(E1), OP19|	3	Evaluates	Both	2
OP853	IMPLEMENTS |(E98)|	1	Alters	External	1
OP854	EVALUATES |R739|	1	Evaluates	External	4
OP855	IFTHEN:DIRECTS |R310, (E1), (E58), OP854|	2	Directs	Both	6
OP856	ACCELERATES |OP853|	1	Alters	External	2
OP857	DECIDES |(E1), R740|	4	Decides	Both	4
OP858	ACCELERATES |(E98)|	1	Alters	External	1
OP859	DECIDES |(E1), OP858|	2	Decides	Both	2
OP860	EVALUATES |(E1), R741|	2	Evaluates	Both	2
OP861	SUPPORTS |OP860, OP859|	2	Alters	Both	5
OP862	CONSIDERS |(E1), R52|	2	Evaluates	Both	2

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP863	CONSIDERS I(E1), R54I	2	Evaluates	Both	4
OP864	MONITORS I(E1), (E52)I	2	Inquires	Both	1
OP865	MONITORS I(E1), R742I	2	Inquires	Both	2
OP866	EVALUATES I(E1), R163I	2	Evaluates	Both	2
OP867	IFTHEN:DOESNOTACCELERATE:UNTIL IR744,	2	Alters	External	4
OP868	RESTARTS I(E41)I	2	Alters	Internal	1
OP869	RESTARTSWITH I(E41), R746I	2	Alters	External	2
OP870	EVALUATES I(E1), R749I	2	Evaluates	External	2
OP871	SUPPORTS IOP870, OP688I	2	Alters	Both	4
OP872	INQUIRES I(E25), (E79), A1(E26)I	2	Inquires	Internal	1
OP873	DIRECTS I(E1), (E25), OP872I	2	Directs	Internal	2
OP874	NEEDS I(E1), A119(E26)I	2	Needs	Internal	1
OP875	INQUIRES I(E1), (E25), R751I	2	Inquires	Internal	2
OP876	INQUIRES I(E1), (E25), R752I	2	Inquires	Internal	2
OP877	WAITS I(E1), R754I	2	Alters	Internal	3
OP878	INFORMS I(E79), (E1), R753I	2	Informs	Internal	2
OP879	WHEN:PREPARES IOP878, (E1), (E259), (E26)I	2	Prepares	Internal	3
OP880	EVALUATES I(E79), (E26)I	2	Evaluates	Internal	1
OP881	INQUIRES I(E1), (E79), OP880I	2	Inquires	Internal	2
OP882	CONSIDERS I(E1), OP1I	2	Evaluates	Both	2
OP883	CONSIDERS I(E1), R238, AND R755I	2	Evaluates	Both	3
OP884	DONOTOCCUR IA94(E17)I	2	Alters	External	1
OP885	UNDERSTANDS I(E1), A121(E22)I	2	Knows	Both	1
OP886	WANTS I(E1), OP885I	2	Wants	Both	2
OP887	MADE I(E22), (E176), OR (E260)I	1	Alters	Both	1
OP888	IFTHEN:KNOWS IOP887, (E1), A121(E22)I	2	Knows	External	2
OP889	HOPES I(E1), R757I	2	Believes	Both	2
OP890	INQUIRES I(E1), (E36), R759I	2	Inquires	Both	3
OP891	ENSURE I(E1), R761I	2	Alters	External	2
OP892	EVALUATES I(E1), R762I	2	Evaluates	Both	2
OP893	DIRECTS I(E248), (E1), R763I	2	Directs	Both	6
OP894	DETERMINES I(E1), A1(E69)I	3	Decides	Both	1
OP895	DETERMINES IR764I	3	Decides	Both	2
OP896	WORKSWITH I(E79), (E29), OP895I	3	Communicates	Both	3
OP897	DIRECTS I(E1), (E79), OP896I	3	Directs	Both	4
OP898	WAITSFOR:DECIDES I(E1), R767, R766I	2	Decides	Both	4
OP899	DETERMINES I(E1), R768I	2	Decides	External	2
OP900	PUBLISHES I(E237), R771, AND R770I	2	Alters	External	4
OP901	KNOWS I(E1), A1(E30)I	2	Knows	External	1
OP902	DETERMINE I(E1), (E134)I	2	Decides	External	1
OP903	READS I(E1), (E30)I	2	Inquires	External	1
OP904	IFTHEN:INQUIRES IR773, (E1), (E265), A1(E31)I	2	Inquires	Both	3
OP905	BUILDS I(E41)I	2	Alters	Internal	1

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP906	DETERMINES:INLIGHTOF |(E1), R779, A109(E3	2	Decides	Internal	2
OP907	KNOWS |(E1), A94(E31)|	2	Knows	Internal	1
OP908	INQUIRES | (E1), (E265), A1(E31)|	2	Inquires	Internal	1
OP909	DETERMINES |(E1), A125(E123)|	2	Decides	Internal	1
OP910	DEPENDSON:DETERMINES |R785, (E1), (E54)|	2	Decides	Internal	3
OP911	IFTHEN:ACTS |R451, (E1), (E87)|	2	Alters	Both	2
OP912	OPERATES |(E41)|	2	Alters	Internal	1
OP913	MUSTKNOW |(E1), R787|	2	Knows	Internal	2
OP914	PROVIDESFOR |(E1), (E202), (E17)|	2	Alters	Both	1
OP915	OBTAINS |(E1), A119(E30)|	2	Alters	External	1
OP916	DETERMINES |(E1), A1(E30)|	2	Decides	External	1
OP917	WANTS |(E1), A1(E31)|	2	Wants	Internal	1
OP918	BEFORE:DETERMINES |OP917, (E1), (E54)|	2	Decides	Internal	2
OP919	INQUIRES |(E1), (E79), A1,R34|	4	Inquires	Internal	2
OP920	BEFORE:DETERMINES |OP919, (E1), A9,R789|	4	Decides	Internal	4
OP921	REDUCESPRESSUREON |A4(E29), A126(E54)|	3	Alters	Both	1
OP922	REDUCES |(E267)|	3	Alters	External	1
OP923	KNOWS |(E1), A1,OP5|	3	Knows	Both	2
OP924	WANTS |(E1), OP923|	3	Wants	Both	3
OP925	INQUIRES |(E1), (E36), R794|	3	Inquires	Both	4
OP926	CONSIDERS |(E1), R31|	2	Evaluates	Both	2
OP927	DETERMINES |(E1), R795|	2	Decides	Both	2
OP928	DETERMINES |R663|	2	Decides	External	2
OP929	WORKSWITH |(E58), (E224), OP928|	2	Communicates	Both	3
OP930	DIRECTS |(E1), (E58), OP929|	2	Directs	Both	4
OP931	CONSIDERS |(E1), (E186)|	2	Evaluates	External	1
OP932	DOESNOTKNOW |(E1), A3,R72|	3	Knows	Internal	2
OP933	KNOWS |(E1), OP8|	2	Knows	Both	2
OP934	INFORMS |(E1), (E25), A1(E186)|	2	Informs	Both	1
OP935	TALKSWITH |(E1), (E25)|	2	Communicates	Internal	1
OP936	NEEDS |(E1), OP935|	2	Needs	Internal	2
OP937	OPERATES |(E1), (E106)|	2	Alters	Internal	1
OP938	UNDERSTANDS |(E1), A94(E4)|	2	Knows	Internal	1
OP939	RESTORING |R805|	1	Alters	Internal	2
OP940	RESOLVES |(E58), A94(E6)|	3	Alters	Internal	1
OP941	DIRECTS |(E1), (E58), OP940|	3	Directs	Internal	2
OP942	RESOLVES |(E58), A94(E34)|	3	Alters	Internal	1
OP943	DIRECTS |(E1), (E58), OP942|	3	Directs	Internal	2
OP944	WORKSWITH |(E1), (E230), (E127)|	2	Communicates	Both	1
OP945	CALMS |A127(E58)|	2	Alters	Internal	1
OP946	MEETSWITH |(E1), (E58)|	2	Communicates	Internal	1
OP947	INFORMS |(E1), (E58), A1,R704|	2	Informs	Both	2
OP948	DEPENDINGON:MEETSWITH |R811, (E1), (E58),	2	Communicates	Both	6

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP949	DOES I(E87)I	1	Alters	Both	1
OP950	INFORMS I(E1), (E58), R813I	2	Informs	Both	4
OP951	KNOWS I(E1), A1(E34)I	3	Knows	Internal	1
OP952	RESOLVES I(E58), A128(E34)I	3	Alters	Internal	1
OP953	DIRECTS I(E1), (E58), OP952I	3	Directs	Internal	2
OP954	DISMISSES I(E1), OP11I	2	Alters	Both	2
OP955	PRODUCES I(E202)I	1	Alters	External	1
OP956	CALMS I(E1), A127(E58)I	2	Alters	Internal	1
OP957	TALKEDWITH I(E1), (E72), (E37)I	2	Communicates	External	1
OP958	UNLESS:MEETSWITH IOP957, (E1), (E58), OP956I	2	Communicates	Both	3
OP959	MONITORS I(E1), A4(E6)I	3	Inquires	Internal	1
OP960	RESOLVES IA94(E6)I	3	Alters	Internal	1
OP961	MONITORS I(E1), A39,OP960I	3	Inquires	Internal	2
OP962	INFORMS I(E79), (E1), A1,R825I	3	Informs	Internal	2
OP963	INFORMS I(E58), (E1), A4(E34)I	3	Informs	Internal	1
OP964	PREPARES I(E1), (E268)I	2	Prepares	Internal	1
OP965	EXPLAINS I(E1), (E45), A4(E54), AND A129(E42	2	Communicates	Both	1
OP966	DETERMINE IA93,OP964I	2	Decides	Internal	2
OP967	MEETSWITH I(E1), (E58), OP966I	2	Communicates	Internal	3
OP968	DECIDES IOP13I	2	Decides	Both	2
OP969	INVOLVEDIN I(E1), OP968I	2	Communicates	Both	3
OP970	WILLINQUIRE I(E45), (E1), A3(E92)I	2	Inquires	External	1
OP971	KNOWS IA3(E92)I	1	Knows	Both	1
OP972	NEEDS:INFORM I(E1), OP971, (E1), (E45), R831I	2	Informs	Both	3
OP973	NEEDS:INFORM I(E1), R832, (E1), (E45), R833I	2	Informs	Both	3
OP974	INFORMS I(E1), (E45), R835, AND R837I	2	Informs	Both	5
OP975	UNDERSTAND IA1,OP13I	2	Knows	Both	2
OP976	NEEDS I(E1), OP975I	2	Needs	Both	3
OP977	DETERMINES IA1(E92)I	1	Decides	Both	1
OP978	WANTS I(E1), OP977I	2	Wants	External	2
OP979	UNDERSTANDS I(E1), R840I	2	Knows	Both	2
OP980	ENSURES I(E1), OP979I	2	Alters	Both	3
OP981	WANTS I(E1), OP980I	2	Wants	Both	4
OP982	INQUIRES I(E1), (E36), A3(E92)I	2	Inquires	External	1
OP983	REVIEWS I(E1), (E270)I	2	Inquires	Both	1
OP984	WANTS I(E1), OP983I	2	Wants	Both	2
OP985	DETERMINES IR841I	1	Decides	Both	2
OP986	WORKSWITH I(E1), (E226), OP985I	2	Communicates	Both	3
OP987	DEALSWITH I(E1), (E270)I	2	Alters	Both	1
OP988	NEEDS I(E1), OP987I	2	Needs	Both	2
OP989	OBTAINS I(E58), A1,R842I	2	Alters	Both	2
OP990	DIRECTS I(E1), (E58), OP989I	2	Directs	Both	3
OP991	KNOWS I(E226), A121(E45)I	1	Knows	External	1

Table 13. List of Unique Operators With Assigned Values for Information Characteristics (Continued)

LABEL	OPERATOR DESCRIPTION	LEVEL OF DETAIL	CLASS	INTERNAL/ EXTERNAL	RELATIONSHIP COMPLEXITY
OP992	INQUIRES I(E1), (E226), R844I	2	Inquires	Both	2
OP993	INQUIRES I(E1), (E36), R845I	2	Inquires	Both	3
OP994	INQUIRES I(E1), (E36), R846I	2	Inquires	Both	4
OP995	WANTS I(E1), R847I	2	Wants	Both	2
OP996	CONTINUES I(E18), A131(E272)I	1	Alters	External	1
OP997	CONSIDERS I(E1), R50I	2	Evaluates	Internal	2
OP998	WORKEDWITH I(E42), (E1), OP17I	2	Communicates	Both	2
OP999	UNDERSTANDS I(E1), A1(E48)I	2	Knows	Both	1
OP1000	WITH:REDUCES IR863, A94(E17)I	2	Alters	External	2
OP1001	CONTINUES I(E54)I	1	Alters	Internal	1
OP1002	DECIDES I(E1), OP1001I	2	Decides	Internal	2
OP1003	EVALUATES I(E58), R856, AND A85,R856I	2	Evaluates	Internal	3
OP1004	DIRECTS I(E1), (E58), OP1003I	2	Directs	Internal	4
OP1005	PRODUCES I(E4), (E202)I	1	Alters	Both	1
OP1006	DIDNOTWORKWITH I(E42), (E1), OP17I	2	Communicates	Both	2
OP1007	EVALUATES I(E36), R869I	2	Evaluates	Both	3
OP1008	WANTS I(E1), OP1007I	2	Wants	Both	4
OP1009	DOESNOTBELIEVE I(E1), (E50)I	2	Believes	Both	1
OP1010	WANTS I(E1), A1(E50)I	2	Wants	Both	1
OP1011	REVIEWS I,R54I	2	Inquires	External	4
OP1012	WANTS I(E1), OP1011I	2	Wants	Both	5
OP1013	INQUIRES I(E1), (E270)I	2	Inquires	Both	1

APPENDIX D. STRUCTURED INTERVIEWS

D.1 Parts I and II of the Structured Interview

The subjects' responses to Parts I and II of the Structured Interview are presented in Table 14. Part I was used to validate the transcripts and resulting coded protocols.

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
SUBJECT 1, EXERCISE 1								
1	Which Rx was shut down?	current	very precise	SR	SR	verbally	<1 hour	most
2	Why the Rx was shut down?	current	very precise	SR	SR	verbally	<1 hour	most
3	How long the Rx is going to be shut down?	current	order of magnitude	SR	SR	verbally	<24 hours	most
4	Impact of Rx shut down on material production (incl. costs)	1 week - 1 mo	5 - 10% error	Planning Group	Planning Group	verbally	several days	most
5	Defense of the Budget	current	impeccable	-	-	verbally	-	most
6	Knowledge relative to RFP	current	-	-	-	verbally	-	most
SUBJECT 1, EXERCISE 2								
1	Impact of treaties on my capability to meet Stockpile Memorandum	current	very	weapons people	staff	paper	24 hours	very
2	Impact of RFP on my capability to meet Stockpile Memorandum	current	best estimate	weapons people	Director OWP	verbal	<1 hour	very
3	K-Reactor	current	very	SR	reactor staff	verbal	<1 hour	very
4	Data I need to respond to the Washington Post article	current	very	site	reactor staff	paper	<1 hour	very
SUBJECT 1, EXERCISE 3								
1	Is the Ohio thing legal?	current	precise	Legal	Chief Council	paper	1 week	very important
2	What happened at FMPC?	current	precise	OR	OR Plant Manager	verbal	24 hours	very important
3	The information about the Reactors	current	precise	SR	SR	verbal	24 hours - w eek	very important

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
SUBJECT 1, EXERCISE 4								
1	Internal Battle	current	precise	Secretary	Secretary	verbal		
2	NPR	whatever	precise	?	Cong. Affairs	paper	24 hours	very
3	Testimony status, prod. goals, reactors	current	precise		staff		3 days	very
SUBJECT 1, EXERCISE 5								
1	Validating the WIPP thing	current	precise	WIPP/ALO	staff	verbal	1 week	most important
2	New estimated time of WIPP	current	not as precise	WIPP/ALO	staff	verbal	1 week	most important
3	Impact of WIPP RECRA/CERCLA	month	precise	Sites	staff	paper	1 week	most important
4	estimate timing and impact of Rx shut down	current	not precise	task force mgr	task force mgr	verbal	1 week	most important
5	update on Gorbachov thing	weekly	not precise		staff			secondary
SUBJECT 2, EXERCISE 1								
1	What caused the reactor to be shut down?	current	very precise	site	staff/Plant Mgr.	verbal	soon	very
2	Is it specific to that reactor or does have consequences for the others?	current	very precise	site	staff/Plant Mgr.	verbal	soon	very
3	Prognosis for restart and impact on production (to meet status quo (demand))	current	very precise	site	staff/Plant Mgr.	verbal	soon	very
4	Supply / demand cases for the potential	current	precise	staff	staff	verbal	weeks-month	very

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
	treaties.							
5	Impact of RF incident, short-term and long-term.	current	precise	OMA	staff/OMA	verbal	weeks	very
	SUBJECT 2, EXERCISE 2							
1	Possible numbers of weapons to be portant retired - associated savings in materials requirements	current	-	staff / DAS/MA	staff	paper	-	not terribly im-
2	RF - status update, implications to NMP; how long down; impact on ability to receive materials or to ship needed components	current	-	DAS/MA	staff	verbal	-	totally important
3	K-Rx - nature of problem; prognosis for restart; implications to other Rx's	current	very precise	site	staff/Plant Mgr.	verbal	quickly	very important
4	P & L - status; do they burp	current	-	-	-			
5	Nature of alleged deficiency; review and evaluation of the allegation by the NMP staff / Dept. staff / Contractor (SRS- Westinghouse and LANL)	current	very precise	site	staff	verbal	not long	very important
	SUBJECT 2, EXERCISE 3							
1	Assessment of impacts on FMPC What's involved in cleaning up? What does clean up mean?	current	very	site	staff	verbal	days	-

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
2	Leak at FMPC-fully understanding All the information--what is it? what leak? Where did it leak to? Was there environmental impact? Do we need a new tank? Transfer material? What resouces do they need from us?	current	very	site	staff	verbal	days	-
3	Reactors--what needs to be done to get them back up?	current	very	site	staff/Plant Mgr.	verbal	-	-
4	DAS/MA--specifics. What haven't we done? what have we missed? Why have we missed it? Is it a problem in HQ? Is it a problem in the field? Are those problems that can be fixed? Is it a management problem in the Field? Is it a management problem at HQ?	current	very	DAS/MA	DAS/MA	verbal	-	-
	SUBJECT 2, EXERCISE 4							
1	Assessment of how long the review will take; how any required environmental fixes would be implemented; impact on production schedule / Rx operations etc.	current	quite precise	env.mgrs	AS/DP	verbal	days	-
2	Family of curves	-	quite precise	staff	staff	paper	< 1 week	-
	SUBJECT 2, EXERCISE 5							
1	Assessment of WIPP impacts on NMP as well as on DAS/MA facilities--primary and secondary impacts, e.g., RF down no need to feed or need to provide some backup	current	precise	EM & DAS/MA	staff	verbally	weeks	-

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
2	Need to be a player on task force; need assessments of impacts of Rx's down (see exercise 4)	current	-	field	staff/me	verbally	some time	-
3	Follow SIS efforts - determine if early deployment helps your situation. Analyze when & where deployment provides product- how much product?	latest	-	SIS office	staff	verbally	some time	not as important
4	Resources to provide cases- run cases; compare base case to alternative cases-inform management	current	fairly precise	DAS/MA	staff	verbally	couple of days	-
	SUBJECT 3, EXERCISE 1							
1	Why shut down?	current	credibly precise	site	staff	paper	< 1 hour	very important
2	How long projected to be down?	weeks	credibly precise	site	staff	paper	1 day	very important
3	How much cost to bring up again?	weeks	credibly precise	site	staff	paper	weeks	very important
4	How serious is RF situation? Probability of going down.	weeks	credibly precise	RF	staff	paper	weeks	very important
5	How serious chance of budget cut?	weeks	credibly precise	site	staff	paper	weeks	very important
6	Possibilities for arms limitation? when?	weeks	credibly precise	site	staff	paper	weeks	very important
7	Scenarios for supply/demand on various assumptions.	weeks	credibly precise	site	staff	paper	weeks	very important
8	Capacity of other sites to make up Pu?	weeks	credibly precise	site	staff	paper	weeks	very important
9	DOD reaction if cannot supply.	weeks	credibly precise	site	staff	paper	weeks	very important

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
SUBJECT 3, EXERCISE 2								
1	What is the "real" situation with the safety analyses? Are they inadequate? How "flavored" or "inadequate" are they? How does this situation compare to commercial reactors?	current	qualitative	site	staff/tech experts	paper	1 week	very important
2	What is the time period to upgrade the safety analyses?							
3	What are the national security implications of keeping the Rx's down that long?		fairly precise					
4	What is the risk/benefit bottom-line?							
SUBJECT 3, EXERCISE 3								
1	What are the policy implications of letting the governor's embargo stand?	current	qualitative	OR/FMPC/Legal	staff	paper	hours/days	very
2	Is there a reason for us to shut down FMPC?							
3	How important is FMPC to meeting our production? needs-in the short term, in the long term are there alternative that could be pursued? (Short-term, i.e., stockpile at Y-12, RF, Long-term, i.e., commercial supplier)							

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
4	What is the situation at SR? Does DP-10 understand the timing for restart at SR? Do we understand their problems?	weeks	qualitative	site	staff	paper	wait	important
5	Can we work better with DP-10 and DOD?							
	SUBJECT 3, EXERCISE 4							
1	What are the environmental problems? How serious are they? What will it take (time/resources) to evaluate and decide on actions needed to correct them? What is our best estimate now? Do we want to give any estimate?	current	precise	SR/EA/ES&H	directly	paper	days	very important
2	What is the supply/demand situation?	current	precise					
3	Where are we in the NPR program? Can it be accelerated? What $$ would be needed?	current	precise					
4	Will DOD testify? What will their position be?	current	precise					
	SUBJECT 3, EXERCISE 5							
1	Object: Develop a new long-term strategy							
2	How extreme are the arms control agreements?	current	fairly precise	sites/responsible	staff/direct	paper	months	very important
3	What is the likelihood of their going through?	current	fairly precise	sites/responsible	staff	paper	months	very important

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
4	Any "build-down" required?	current	fairly precise	sites/responsible	staff	paper	months	very important
5	What is the prognosis for the SR Rx's?	current	fairly precise	sites/responsible	staff	paper	months	very important
6	What is the SIS break-through and could it contribute to the waste problem?	current	fairly precise	sites/responsible	staff/direct	paper	months	very important
7	What is the projected need for Pu? T?	current	fairly precise	sites/responsible	staff	paper	months	very important
8	How bleak is the WIPP situation? What are the alternatives for storage? How long could they take?	current	fairly precise	sites/responsible	staff	paper	months	very important
	SUBJECT 4, EXERCISE 1							
1	Major aspects of positions on arms limitation talks including probability of success and potential range of impacts	< month	not precise	DOE Arms Control	Planning group	paper	indefinetly	very important
2	Best estimate for when a treaty might be consumated.	< month	not precise	DOE Arms Control	Planning group	paper	indefinetly	very important
3	Good definition and breakdown of NMP budget & controls to prevent W,F,&A as a basis for briefing for congressmen.	>month	precise	contractors	staff	paper	< 1 week	very important
4	Strawman strategy to accomodate a budget cut based on probable arms limitation talk outcome	>month	precise	contractors	staff	paper	< 1 week	very important
5	Potential impact of 25% budget cut on NMP operations & affected congressional constituencies.	>month	precise	contractors	staff	paper	< 1 week	very important
6	Details of RF contamination incident including root cause & lessons learned to apply to DOE sites.	current	not precise(acc)	RF	staff	verbal	indefinetly	very important

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
7	Reason for reactor shutdown, Corrective actions being taken, Impact on material supply, Plans for restart	< 1 week	precise(acc)	SR	staff	paper	1 - 2 weeks	very important
8	Is shutdown cause generic to other reactors? If so, what is plan to minimize impact & correct problem?	< 1 week	precise(acc)	SR	staff	paper	1 - 2 weeks	very important
	SUBJECT 4, EXERCISE 2							
1	Details of how agreement will impact demand for nuclear materials & potential if NMP facilities will be required to process retirements	a month	precise	DOD/MA	Planning people	paper	several mths	critical
2	Re-do of supply/demand charts based on above.	a month	precise	DOD/MA	Planning people	paper	several mths	critical
3	Cuase of K-reactor problem, any root causes contribute to problem, corrective actions required--both specific to that problem & more generic to root causes.	< 1 week	precise	contractor/FO	Program Mgrs	paper	< 1 week	critical
4	Applicability of K-reactor problem & root causes to other reactors.	< 1 week	precise	contractor/FO	Program Mgrs	paper	< 1 week	critical
5	Effectiveness of contractor/F.O. response to K-reactor problem, corrective actions, etc.	several wks	precise	contractor/FO	Program Mgrs	paper	< 1 week	critical
6	Basis for allegation in internal memo concerning safety analyses, validity of allegations, seriousness of deficiencies, i.e., impact on risk.	current	precise	contractor/FO	Program Mgrs	paper	days	critical

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
7	Corrective actions required to address deficiencies if they truly exist. Can reactors be operated while deficiencies are corrected.	current	precise	contractor/FO	Program Mgrs	paper	days	critical
8	Impact of FBI raid on RF operations, & thus on material supply/demand.	current	general	MA	Program Mgrs	verbal	month	critical
9	Cause of FBI raid - applicability to NMP facilities.	current	general	MA	Program Mgrs	verbal	month	critical
	SUBJECT 4, EXERCISE 3							
1	Basis for governor's concern with FMPC	current	accurate	state	Program Mgrs	verbal	weeks	very important
2	Plan-what is needed to resolve governor's concerns.	current	accurate	contractor/FO	Program Mgrs	paper	weeks	very important
3	Cause of tank leak - is there a generic / root cause issue that needs resolution?	rapid	accurate	contractor/FO	Program Mgrs	paper	days - 1 wk	very important
4	Cause for reactors being down - plan - what is needed to resolve issues & restart reactors?	weeks	accurate	contractor/FO	Program Mgrs	paper	weeks	very important
5	What potential options are available to - minimize material supply impacts on weapons builds, - provide other sources of material (accelerated residue processing, etc.)	weeks - months		staff/MA/Field		verbal	weeks - mnths	very important

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
SUBJECT 4, EXERCISE 4								
1	What initiatives/policies George Bush wants implemented that could impact NMP activities.	weeks	not real precise	Those offices	superiors	paper	1 month	critical
2	What are the Secretary's priorities/ policies on environmental issues versus defense needs?	weeks	not real precise	Those offices	superiors	paper	1 month	critical
3	What are the environmental standards we are going to be judged against?	week	not real precise	Those offices	superiors	paper	1 month	critical
4	How do we stack up against these standards?	week	not real precise	contractors/FOs	Program Mgrs	paper	1 month	critical
5	What is needed (plan) to correct deviciencies?	week	not real precise	contractors/FOs	Program Mgrs	paper	1 month	critical
6	Impact on supply/demand of reactor down-time - potential options for minimize impact - potential impact on weapons builds.	depends	not real precise	staff	staff	paper	1 month	critical
SUBJECT 4, EXERCISE 5								
1	What is the true status of WIPP? Scheduel for coming on-line & impacts of new schedule on NMP facility operation.	month or 2	inprecise	EM	staff	paper	month or 2	pretty critical
2	Impacts of WIPP slippage on OMA facility operation - if adverse impact, impact on material supply/demand must be estimated.	month or 2	inprecise	OMA	staff	verbal	month or 2	pretty critical

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
3	Same information as on previous sheet for reactors.	quickly	inprecise	site	staff	paper	month or 2	pretty critical
4	Assessment of break-through on potential for acceleration of SIS implementation & impact on cost for implementation.	months	inprecise	SIS project	staff	paper	month or 2	pretty critical
5	Assessment of the probable range of arms limitation options being explored & their impact on supply/demand.	weeks	inprecise	Arms/DOD/OMA	staff	paper	month or 2	pretty critical
6	Integration of above impacts on supply/ demand to provide a best estimate supply/demand scenario & the probable range of possibilities to assist in decision making on urgency of reactor restart, need to accelerate SIS, urgency to get WIPP on-line.	month or so	inprecise	planning people	staff	paper	month or 2	pretty critical
	SUBJECT 5, EXERCISE 1							
1	More specifics on SR reactor shutdown	current	quick & dirty	site/FO Mgr	staff	verbal	< hours	essential
2	More specifics on RF incident What kind of contamination? How could it affect my facilities?	current	general	RF/SR	staff	verbal	< day	essential
3	25% budget explanations Age of data they're using	current	-	wherever	resource mgr.	verbal	not urgent	essential
	SUBJECT 5, EXERCISE 2							
1	Safety Analyses	current	precise	SR Manager	SR Manager	verbally	morning	extremely

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
2	Update on K-reactor	current	precise	SR	staff	paper	weekly	?
3	Background on RF, FBI	current	general	-	staff	verbally	couple days	helpful
4	Gorbachev / Pres. Bush detail impacts.	current	precise	OMA	staff	verbal	days	-
SUBJECT 5, EXERCISE 3								
1	SR status	current	precise	SR	staff	verbal	days	very important
2	FMPC status	somewhat less	less precise	site	staff	verbal	days	very important
SUBJECT 5, EXERCISE 4								
1	Environmental review	up-to-date	precise	SR Plant Mgr.	staff/direct	verbal	driven	very important
2	Impact on stockpile			planning group	staff	paper	driven	may or may not
3	Letter of invitation, staff getting info	current	precise	Cong.Affairs	direct	paper	driven	very important
4	Congressional background info re NPR	current	precise	Cong.Affairs	staff/direct	verbal	driven	not as important
SUBJECT 5, EXERCISE 5								
1	Quick-look on storage capacity NMP sites	current	precise	sites	Division Director	verbal	week or so	necessary/important
2	Assessment of special task force review	current	precise	SR	staff/direct	verbal	quick	important
3	SIS technology	current	precise	laboratory	Division Director	paper	no concern	not relevant

Table 14. Subjects' Responses to Part I and Part II of the Structured Interview (Continued)

	INFORMATION	AGE	PRECISION	GENERATION SOURCE	COMMUNIC. SOURCE	COMMUNIC. FORM	AVAILABILITY	IMPORTANCE
4	Look at stockpile that are evolving from Bush/Gorby discussions	current	precise	DOD/OMA	Planning Group	paper	-	very important

D.2 Part III, Question 3.1

The subjects's responses to Question 3.1 of the Structured Interview follow.

SUBJECT 1, EXERCISE 1

"...no decision to make except passage of information."

SUBJECT 1, EXERCISE 2

"... I haven't made a final decision. The one thing I'm going to start worrying about right now is with a shortfall, and we are cutting down the number of weapons in Europe. That means that there would be plutonium available for recycle and tritium available for recycle. If the Rocky Flats Plant closes down, that means that we cannot ship plutonium to them. So, I'd be starting to look at the options of whether to change charges in the P-Reactor and the L-Reactor if they are on plutonium. I'd look at those needs and compare that to the tritium needs and look at maybe switching the production based on those changes. When I know what the start-up time for the reactor is and when all the numbers come in on the weapons, and then when I get some better feel for the Rocky Flats thing, then I'll decide whether I change charges or request charges be changed in the other reactors. Because there's nothing you can do as NMP Director. So I've decided until I get the information, to hold off. If I get enough information from this that says I should make some changes, then I'd ask SR to give me the impact of that before I made the final decision."

SUBJECT 1, EXERCISE 3

"... The only thing I can make a decision on is the reactors. If it's found that the governor was legal in Ohio, I've got to find another source which is a major episode. So that one is going to give me major pain. When I get the information, I'll make the decision. You can get people doing things."

SUBJECT 1, EXERCISE 4

"... I'm going to resign or stay. If certain things come about, I'm gone. So forget it, somebody else can worry about NPR and the testimony too."

SUBJECT 1, EXERCISE 5

"... I'm going to find out what the hell is going to happen and then I'm going to decide what I'm going to do about it."

SUBJECT 2, EXERCISE 1

"... About all it's done to me, when I get all of that, even the scenarios, the Bush, the budget and everything else, I'm still in the mode of I've got to keep what I've got going. So that's what I've been looking to do. So, that to me is the only decision is How in the hell do I preserve what I've got. I hope I'm saying this right. That's the decision I see and it's how to preserve that. And that's why I say the thing that I'm focused on here is that reactor and it's implications to the other reactors and my continued ability to operate those reactors. Because the one thing that's absolutely clear from over here is I have to keep the three reactors operating. And in fact, I have to get more out of them than I've got, because I don't have enough today. So at this point, that's it."

SUBJECT 2, EXERCISE 2

"... I really haven't made a decision. The decision I've made is I've got, I guess I've come to this, I'm still in the mode of I've got to get every reactor operating day that I can get. That's the decision. I haven't been able to change that decision. It's still confirmed. Now what it's telling me is I'm starting to get more vunerable. I've got a safety issue alleged safety issue I may have to deal with. I've got to get to the bottom of that. The decision is give me that information so I know whether I do or I don't. Because if I do, I'm going to have to adjust what I'm doing to the reactors, and it's going to go against me not for me. The other stuff is ho-hum. Rocky Flats it's, the only decision there is if there not going to give me some reserviors that I was planning to load at Savannah River, or that I'm going to have to start storing some plutonium in some form because they can't take it off my hands. So no decision there yet, necessarily. So the key decision is do I have a safety problem with the reactor and that depends on the answers. And if I do, I need to deal with it. Right now, I'm still on I got to keep those suckers rolling."

SUBJECT 2, EXERCISE 3

"... I'm not sure any decisions were made, unless you were looking to improve the system in regard to the charge by the DAS/MA. You might decide to do a fix on the system, or the way things are reported, or the way people do business with each other or something like that. "

SUBJECT 2, EXERCISE 4

"... It looks like these decisions have been made for you. All you're doing now is presenting the impact. You didn't take it out environmentally, the Secretary did. So you're telling him what the consequences of what he did are, or what the prospects are. And you're going to tell the Congress the same thing. Because it's now a new factor. Before he took it out, I would have had curves and according this, I'd have been in trouble already. Now he's going to impact it negatively unless I have some workarounds."

SUBJECT 2, EXERCISE 5

"... This one has a few potential decisions none of which you'd make right away. Some of them could lead to, as you lay out to the decion makers what support, if any, you might provide as a result of the impact of WIPP. It can lead to decisions. The reactors--there's no decision now other than the decision I've got to be a part of this, and we are going to be a part of this, and we are going to stay closely coupled and we're going to know what's going on here and we're going to, that has a whole host of things. The environment, once they do this review, if they find nothing and you presume they're not, that's why they're doing a review, somebody smells something, you've got to make the necessary modifications and all to make it happen. SIS, not quite as, there's not really an SIS decision. You're going to provide information to them. Hey decision maker, that sounds wonderful what they're saying. Take a look at this curve that I've got. If you could deploy it in this many years, you could help the current plutonium problem I've got. You might want to weigh that, however, opposite some of the other scenarios that are coming down that suggest we need so much less plutonium that the Department might not want to invest the monies that it would take to deploy this stuff early, for instance. But that wouldn't be my decision. I would be laying out the information for somebody else to decide. I would be the analyst, if you will, that would help them with that decision. And finally, the stockpile cases, again, nothing happens until they sign the treaty. So there's a case where you say, guys, this is the results of these various treaty scenarios and what it does to our ability to meet the current stockpile. And this is the changes and this is how much better off we are. And you can show them all the advantages to these treaties that might ensue. Or you might even show that for certain of these materials, there still will be, even though it's reduced, there will still be shortfalls in certain time periods. That's what all this stuff will analyze."

SUBJECT 3, EXERCISE 1

"... I will assume that when I asked about the reactor, when we found out, the immediate reaction was the reactor will be down for some months. And we started to do supply/demand curves based on that. And as we went through the couple of weeks to do those things, we got more information on the reactor and it turns out that our best projection would be about a year. So we firmed those up. And we made a decision to, well let's say that the answer was, that given that there was some possibility of Rocky Flats going down, but we don't know what it is yet, and there's some possibility of arms control, but we don't know what that is yet. That we didn't want to make any committment to new facilities based on this information that we had right now, because there were possibilities that we might be able to do without the material that would be produced within that year. And we had some excess capacity, we weren't going to run out in seven years. So we might be able to make it up in another, we would be able to wait for some period of time before taking an action. So I will make a decision which is a non-decision. The decision not to take any budget actions, not to start up any new facilities, like at Richland. And to wait six months."

SUBJECT 3, EXERCISE 2

"... There's one other way to go at this. That is you shut the reactor down and then you find out and then you have lots of time. Then you have much more time. If the reactor's down, you have much more time to deal with the final decision. If your final decision is shut the reactor down, then you don't really need all of this information. You make a decision to shut it down. But I think, given this is an internal contractor memo that hasn't been reviewed by anybody, I would not do that based on just that information."

SUBJECT 3, EXERCISE 3

"... The final decision I made was to call a time-out at Fernald. Not ship any material out of Fernald for several weeks to reassess the situation, send a team down there to look at it. Thereby not confronting the governor on his instance that there be no shipments and saying all right, we're going to assess it since you've raised the issue. I would have made that decision with the Military Application people after looking at the supply/ demand situation for Fernald, and I'm making the assumption that we had enough stockpile at the sites that were needing their product to be able to do this for several weeks or months. And that we even had the idea that should Fernald never come up again it wouldn't be, we might be able to get through anyway. So I think on that I would be very confident and I would have a good feeling about having made that decision. One the other part of it about the situation at Savannah River, I think it's a different kind of decision. And I was dealing

with one about how to decide together whether we had a real problem at Savannah River as far as our conduct of the program. Were we being too conservative. Were we not being responsive enough to the national security needs to meet peg points. Or did they just not understand how serious this was for the long term. And if we did anything to push the program on this peg point issue that we mightnot have the reactors. It might make the situation worse, if we tried to bring the reactors up too quickly. And I think that that would be a very hard decision. I think I would be moderately confident that I had come to the right thing and maybe good, because that's a tough one."

SUBJECT 3, EXERCISE 4

"... The decision that we made was to present to the House Armed Services Committee a plan for dealing with the environmental issue at Savannah River. And a projection on, kind of a decision plan idea that the Secretary started us down the road to do which has proven to be really good. How were we going to get to the decision? What do we know now? What do we project based on what we know now? When are we going to get more information? What are we going to do with the more information when we get it? When do we think we'll know enough to come back to them with a recommendation, for example on whether we should accelerate the New Production Reactor or not. And to the DOD about whether they have to start making some adjustments in the demand because we're not going to be able to meet them based on what we know."

SUBJECT 3, EXERCISE 5

"... What actions to take for a new long-term strategy? That is should we be establishing, I would make the decision to establish back-up storage facilities for transuranic wastes because we might not have WIPP. To deal with the SIS, either support SIS or not support SIS. Those would be my two, say, basic decisions. Savannah River reactors, I think, has been taken out of our hands. I think we're basically reactive in that, just trying to find out what is the condition of the reactors, why was it shut down, and what are the projections. So we'll know whether they're likely to be up or down. But we're probably not going to be in charge of that decision."

SUBJECT 4, EXERCISE 1

"... If I got information on the arms limitation talks, sufficient information and it looked like it was really going to be firm, and also that the we were going to end up getting a budget cut, my decision would be to use this information to steer where we would take the budget cuts. Short of that, let's say this budget cut situation,

we were able to forestall it by making the decision to go over an brief the congressmen, and we were able to forestall this, I would use this information on, potentially on decisions that come along day-to-day on our facilities. For example, if it looked like the arms limitation talks were going to result in a situation where we were going to have an excess of plutonium or certainly sufficient supplies of plutonium without making, well without making new plutonium at Savannah River, we would probably defer project improvements to facilities that might ultimately be shut down in that case. In other words we would use that, if it looked like these talks were being successful and were going to ultimately result in a significant in reduction in requirements for nuclear materials, we would defer any actions that look like they would probably not end up having a pay-off. On the contamination incident, the decision would be once we had the evaluation of it, the decision would be to communicate that to our plants if there were lessons to be learned from the from the incident. On the Savannah River reactors the decisions would be, the main decisions there, I think, would be to judge whether the field was taking appropriate actions relative to correcting the situation with that reactor. Whether they were adequately judging the applicability of this shutdown to the, cause of the shutdown to the other reactors. And decisions if there were lengthy shutdowns involved, it would be reviewing adequacy of the field's response to those and to minimize the period, the shutdown periods, and then to make adjustments to, in the NMP system if that was going to cause a shortage of material in the near-term, we would want to look at alternatives to try to minimize the impact of that."

SUBJECT 4, EXERCISE 2

"... In terms of the arms control agreement, I would need a supply/demand analysis and the decision would be that, there may be a number of decisions coming out of that. In other words, if it's a radical enough agreement it could impact the course of operation or upgrade of existing facilities. We might want to decide to shutdown some facilities or terminate upgrades of some facilities or that kind of thing. It also impacts the, it may impact my recommendation on the reactors. It may turn out that because of the arms control agreement, we have time to make, to take corrective actions that we, if the supply/demand situation were as it is in here that we were going to be short in 7 years, we would try to minimize the downtime and thus do only those essential corrective actions that are absolutely required to meet our safety objectives and try to defer maybe future, further corrective actions until sometime later. The arms control agreement might permit us to take a more, I wouldn't say leisurely, but be more conservative in our approach and operation. On the reactors, my decisions there would be agreement with what the contractor and field offices were doing on K-reactor. I may make the decision that we really need to shut down P and K depending on what we found out on K and also

what we found out the allegations on the internal memorandum. And basically,decisions would be involved in assessing whether the field was doing an adequate job in looking at the root cause of the problem with K-reactor, looking at the allegation on adequacy on safety analyses. On the Rocky Flats operation, my decision there would be to try to anticipate what the impact may be on supply/demand situation because it's going to impact the supply of plutonium and the demand for plutonium and tritium potentially based on information I get there. And also I'd look at is there anything in the cause of the FBI raid that would be applicable to my facilities, and I might want to take action to assure that the contractors and field offices are properly discharging their responsibility relative to, if it was because of a RECRA problem, to RECRA."

SUBJECT 4, EXERCISE 3

"... On Fernald, my decision, of course this is all predicated on that we continue to need, there's nothing in the scenario on arms control or anything cutting back, so I'm assuming we still need plutonium. So there my decision would be there to try to find out from the state, from the governor what his concerns are and then my decision would be to implement a plan of action to resolve the governor's concerns. And that's going to be a major thing because it's going to involve getting support. It may mean getting reprogramming money and all that. The decision on the tank leak is mainly has the site taken appropriate corrective action? Have they done a good job in determining the problem? and is there a generic/root cause issue here that needs to be resolved and are they really working to resolve that root cause issue. The decision on the reactors is have we really fully determined all the issues that need to be addressed before they can be restarted? and do we have a plan in place? development of a plan and implementation of a plan in place to resolve these issues and restart the reactors in a reasonable time frame. And decisions on, the decisions on, also to reduce the impact on Military Applications on builds would be decisions on things like options to minimize the impacts, maybe we want to accelerate some of our residue processing or site returns orbottles coming back, that kind of thing."

SUBJECT 4, EXERCISE 4

"... Policies and priorities and so on of the President and the Secretary, and my decision there would be to determine how to implement those and to make sure my organization was fully informed on what these new directions are if they are changes direction. And then, the decision has been made by the Secretary that we're going to do this review, shut down the reactors, so I would need to get the standards that we are going to be judged against and implement the review, whether it's going to be up to me or whether somebody else is going to make the review, I'm not sure of in this exercise, but if it's not me that's going to make the review, I would

go ahead and implement the review, setup the review, go ahead an do it, and make the decision to develop the plan and get the necessary support to implement it promptly. The main thing is to move out quickly and get this new direction communicated throughout the entire organization, both at the field level and in headquarters, and get on with fixing, evaluating ourselves and fixing the problem. And impact on supply/ demand, the decision, my decision there would be to get the information, the supply/demand analysis, make decisions on any options for minimizing that and of course provide that information to the Committee."

SUBJECT 4, EXERCISE 5

"... WIPP, the only decision on WIPP would be a decision to really appeal or raise the issue to the Secretary if we have a real problem with slippage that's really going to impact our activities or OMA's activities such that it would impact our's adversely. The reactors, well the same decisions I talked about before on the reactors. On the acceleration of SIS, excuse me, on the SIS break-through, the decision there would be, I think we would want to reevaluate the program, but we couldn't do it in, based on that break-through what do we want to do. Do we want to accelerate implementation of the project? That kind of thing. But that has to be done in concert with all these other impacts on the supply/demand scenario. We may want to even just abandon SIS if the arms control situation looked like it was really heading toward no more plutonium, I would just want to hold probably on SIS decisions until we got a firm arms control feedback. So that's really basically, once we get an integration of all these impacts on supply/demand, including the reactors, the potential schedule for restart of the reactors and so on, we might want to make some decisions on alternatives for supplying material or what have you. But until we integrate all this information together, and it will be a very grey situation. We'll have probably, here's our best estimate the way things are going to go and then if the arms control goes this way and WIPP goes this way it could be this bad or it could be this good. So we'd have a range."

SUBJECT 5, EXERCISE 1

"... If the problem I was told about at Savannah River about one of the reactors was shut down, if that was going to be an absolute, long-term thing then I would start wondering about other options for meeting stockpile requirements. ... the final decision would be some recommendation as to what we did given the fact that we know we're supposedly going to be short in material. If the answer was the other reactor had to go down, we would come up with some sort of recommendations as to what we'd do."

SUBJECT 5, EXERCISE 2

"... The final decision I made on how I was going to approach this, I feel very confident in that approach, that decision, meaning the decision of what I'm going to do. ..."

SUBJECT 5, EXERCISE 3

"... I'll make an assumption on these that the final decision is just some sort of continuing to make progress. We had an established plan that we were going to follow. ... On the Savannah River I don't see it as a final decision. I see it as a status as far as we're not going to be making an immediate decision on something crazy, I don't think."

SUBJECT 5, EXERCISE 4

"...I'm defining my final decision as being that prepared statement that we'll make before the House Armed Services Committee."

SUBJECT 5, EXERCISE 5

"... The decision I've kind of made on the storage capacity at NMP sites, I was trying to get a quick-look handle on whether I had an immediate crisis because of operating. And I don't think there's, so all I'm trying to do is reach a decision that I don't need to worry right this minute. And based on this data that I'm going to get. So the final decision I make is obviously going to be dependent. I'm making an assumption my final decision is I don't have a big problem and therefore, all I'm doing is backing up the decision by gathering the data. ... assessment of the special task force review has a much more critical sense to it. Again, I'm kind of bouncing that off on the fact, or that better stockpile conditions are coming out of the discussions, but my whole idea is trying to decide whether I've got a problem. And my final decision, if I can in this area is, I'm going to make the assumption, that things are going to be okay. And that although I'm in a tight situation, I can, this is, things will be okay. ... SIS technology, my decision there was I wasn't going to get too excited about what I've seen here. I don't see it as being absolutely even new technology going to help meet immediate needs. So the idea of asking my Division Director to go check this whole thing out and don't get too excited about it. ... As far as looking at the stockpile which is evolving and the Bush/Gorbachev discussions, what I've done there is I've asked for certain things to happen those to be sketched out so I can understand what they mean regarding my overall scenario I'm operating in over here with regard to the stockpile situation. However, when that data comes out, I'd have to feel that it's always changing and it's

always suspect. And although I don't want to go off and tell anybody that all of a sudden, if it comes out that the situation hasn't significantly improved, I'm only somewhat confident in relaying that because there has been a tendency for things to get better instead of worse in that area. So again, depending on this whole area is somewhat volitle, ..."

D.3 Part III, Questions 3.2 and 3.3

The subjects responses to questions 3.2 and 3.3 are shown below in terms of the number of subjects responding to each possible answer.

3.1 How confident are you in that decision?

10	a. Very confident
6	b. Moderately confident
5	c. Somewhat confident
0	d Not confident
4	NO ANSWER

3.2 Do you feel it was a good decision?

5	a. Very good
12	b. Good
3	c. Fair
0	d. Poor
5	NO ANSWER

APPENDIX E. EXIT QUESTIONNAIRES

The subjects' responses to the questions in the Exit Questionnaire follow in boldface type. The order of the responses varies and, in some instances, the responses were edited to ensure anonymity.

1. Did the exercises stimulate the kind of thinking that you did when you were, or when you supported, the Director of the Office of Nuclear Materials Production? (Yes or No) Why?

   Yes. It had some validity in the scenarios of things that had actually happened and it reflected back on some of those things that had happened in the past.

   Yes. Because these are the kinds of things that do happen, the arms control impacts, the reactor impacts. WIPP is less connected, but things like DWPF, in-tank precipitation, a lot of things happening on the waste side and what their impacts are on operations we've had to get involved. So yes.

   Yes. Because they were very much real life. You had to decide who you were going to ask for the information and how long you needed to put it together and whether to tell the people above you wanted the decision whether they had to wait. I mean it was very real life. Because the managers above you almost always want the information immediately, yesterday, verbally. So the kind of questions about do you really have to have the information immediately, could you wait, would it be better if you waited, is it preferable to have it in writing or on a graph or not verbally or not in just numbers, that was the kind of thing we had to do. Sometimes we succeeded and sometimes we failed.

   Several of them did and I obviously support them instead of actually being them. But these are my second guess things that I would typically wind up doing. Several of them, I wouldn't, I guess my most, these are things I'd logically be doing. I wasn't sure exactly my decision. Decisions were kind of what I was lacking because I couldn't figure out in many cases where I was really deciding things. I was really gather data and trying to process it and decide what to go on with and I have a hard time labeling that. I always think of decision as more finite, and I'm sure that's not exactly true, but anyway.

   Yes absolutely that they did. Because as, when we opened up in the beginning of this thing when I went down this base case, if you will, these basic assumptions, I said that was very realistic because that's the way things were in the 1988 time frame, or just about, the reactors going down in the summer of 88. So, you know, for a little while this was true in 88. A little while. So, from that point of view, absolutely. That's why. It's the way it was.

2. Did the exercises represent problems the Director of the Office of Nuclear Materials Production might actually face or might have actually faced in the past? (Yes or No) Why?

Yes. And I think we've talked about how they're very realistic.

I'd say yes. And the reason that I say that is I think is obvious from the previous tapes through some of these exercises, some of them are thought processes, it's almost like I'd done it before. I think I walked through the thought processes that I had faced on a number of these things already. That's why I'd say yes.

Obviously I can't precisely. I would say based on the kinds of issues that have been coming up over the last several years, the answer is yes. Because many of these same situations are, without getting classified, do exist. And therefore, they do have relevance to recent problems that the Department has experienced. Certainly with the Secretary deciding to do certain reviews, and data coming out of Gorbachev/Bush discussions, I think they represent, pretty well the problems that are faced.

I just answered that, I guess.

I think in a lot of cases the answer is yes. Changes in policies when new administrations come in, Secretaries making decisions that we wouldn't have recommended but they're made and we have to implement, changes or break-through's in technologies occur, or the reverse of that, set-backs and we need to re-evaluate, and then the arms control situation is certainly relevant.

3. Were the exercises representative of the variety of high-level problems the Director of the Office of Nuclear Materials Production might actually face or might have actually faced in the past? (Yes or No) Why?

Yes. Because I'm aware that they have been faced in the past. There are a lot of mundane things that go on that are problems that never reach the other levels of these, but they also take a lot of time. A lot of the things that you could throw in here that are the normal run of the mill things that aren't the great, strategic things that, mixed in with some of these others might have more reality to the scenarios.

Yes. It covers both, the range from political to technical so I think that is the case. The variety ranging from having to testify to having to make decisions on actual incidents at facilities.

I would think so, again for many of the same kind of reasons I just gave in number 2. Some of them are very real, live and actually have occurred.

Yes. Very much so. Curiously enough, I think they also represent what we are facing now and what we are going to face in the future. Particularly with regard to the START treaty, the impending START treaty. I think we're going to be doing a lot, walking through a lot of the what-if's that we've talked about today, believe it or not. We've already generated some START curves, for example, to say what

is the impact on those materials. What happens? and what happens to your need to run the reactors and when do you need them? So the answer is absolutely representative and they are very realistic and they are very true to life today.

Yes. Because everyone of those exercises had an element of a high-level decision in it. Not all of it was. I mean the decision of how to prepare for a congressional hearing was not, on the surface of it not that kind of a decision. But on the other hand it was, because whether or not to accelerate the new production reactor program is a very high-level decision. Or whether or not to agree to shut down a facility is a very high-level decision. And I think that they are the kinds of things and the strategic decisions of what to operate and what not to.

4. Would you consider the scenarios in the exercises as strategic scenarios? (Yes or No) Why?

I think they are both strategic and tactical. I mean there are some immediate things plus they also involve longer-term strategic decisions. Especially having to do with the decisions on how we want the complex to look in the future relative to the needed kinds of facilities to meet future requirements. And of course, the arms control agreements will affect that significantly.

I've been involved in strategic planning and this stuff as opposed to tactical which tends to be more near-term, and therefore how you go about solving some of the scenarios and the conditions that were given, I think they tend to border then on the strategic. Some obviously, the near term actions of how you respond to congressional testimony I don't think didn't. But where do you go with storage or how do you think through reactor situations and all that did.

I would say so from the standpoint that for at least some of the events that you're talking about they do suggest or point you toward the strategic planning for the future. What do you need to do to posture yourself to either work around the given problem or to solve a certain problem or to meet a requirement in the future. So, from that point of view, I'd say yes it does meet the test of a strategic scenario.

Yes. But I feel it presents the problems or concern, but it doesn't, to me, if you could create a scenario that says and it's going to be down for this period of time or that period of time, to have a person deal with more data in an evaluation so that in some cases somebody might want to make a decision or somebody might not want to. That might play, because I think you then might have, I don't know who would make decisions on any of this. I haven't heard the other things and all. They're strategic and all, but they don't carry through. They just present a problem and then don't give you any data or information to deal with and say, okay, here's what your feedback was, now what are you going to do. Which I think is more a reflection on a manager's, what he's going to do. This is a data junkie's exercise, tell me all the information you have to make a decision, or whatever. And so all the data junkie's will play. I think it's more realistic when you give them some of the data and say now what are you going to do.

Yes because of that reason. Every single one of them had an aspect of if you didn't look at it as a strategic issue, you would quickly get into trouble. Because if you dealt with it as a, and in some when I look back, I probably didn't always deal with it that way, but I, as looking back on it, if you dealt with the immediate problem, even just as simple minded as when the governor of Ohio shut the state down, if you just dealt with this as being should we or not give in to this governor today, you'd quickly find yourself having made a decision that does affect long-term things without having thought about it. So I do think they all did have strategic.

5. Were the exercises challenging? (Yes or No) Why?

Yes. Because the exercises often consisted of a number of different factors or incidents or issues that weren't necessarily closely related and therefore they had to be integrated.

Yes. One of the reasons they were challenging was because you had to make some assumptions in doing it. Some of them were complex--they had these pieces that didn't necessarily relate to each other, you know, Rocky Flats had an incident, well so who cares, you've got the Savannah River reactors down. You had to figure out what these things might have to do with each other. And also because there are going to be a lot of factors involved and it's hard sometimes, just sitting here, think about all the things that you would need to factor in, like political aspects, and organizational aspects to it, and where you would get the information from. What's the real answer to that question? What's the really good answer to that question? I know there are no right or wrong answers, but what's a really well thought out answer to that question? And I would think of things later that I had answered quickly, so I do think they were challenging. The answer wasn't obvious for a lot of them and there were a lot of different ways you could have gone at some of those things.

No. I'm sorry. Because, you know, it's kind of automatic what you do. You've got to go find out information/ data and then you make a decision, but there was no capability in this exercise to make any meaningful decisions.

Yes they were challenging, but I feel probably that I, if I'd had, if I'd ever been in the actual chair I would have had more examples, I kind of do this thinking on the side. I don't have to really do it for my major responsibilities. So what you had was some of my second guessing stuff as opposed to real life, I had to worry with it.

Yes, I think so. Maybe only because when you sit down and try to talk out what you routinely do day-to-day, take-for-granted, when you try to describe to somebody else and to put it succinctly, that's a challenge. I would say that's how I see it challenging. I think they were very good exercises.

6. If you faced these scenarios in the real-world, do you think your responses would be different? (Yes or No) Why and how?

I don't think so. At least I tried to give real-world responses here. I saw some of them as I just stated, as real-world questions, some of which I have faced or I am facing today. So from that point-of-view, I'd like to think that I didn't say something different than I would have done. I'm think that I have told you what I would do if it was real-world. And that certainly was my objective.

I did face them in the real world. And the greatest difference probably was that we lost on the issues on how quickly people needed the information and in what form more times than was good. And so we felt we had to go ahead and give recommendations or present information quickly, not based on waiting on data that I would have liked to wait for. And so, I think that I, in real life, some of the decisions, at least some of the initial decisions we made were re-made several times, because the initial decision didn't wait. When I think particularly about the Savannah River reactors, we stumbled several times trying to keep those reactors up. And then, finally, saw that that was not the right answer. That the right answer was to stop and wait and step back and take your time. And really see what the situation was and take a hard look at what we could and couldn't live with as far as the demand was concerned. And go through some real agonies about it and then come up with a scenario. So, I think that the difference was that, maybe now I've learned, I can see it right now we're still doing the same kind of thing. There's just is a tremendous pressure to come up with answers quickly. And it's very difficult to resist that pressure. And to say you don't really need it now. So that would be my main comment about responses being different.

And the other one, I think, is another human compulsion, to get the information directly from the source and not through the staff, through the managers under you, to allow them to put their expertise into it, to give you a better picture of it through their eyes. And that you shouldn't be, it isn't really good for you to be the one taking in all the information yourself and trying to integrate all this stuff and forming an answer. So there were a lot of times when I said I would ask the staff to do this and that, when if I faced it in the real world, I know that there would be a compulsion to get some of that information myself. So I would have to control that as I go through these things in real life.

Probably. More of a reactionary situation rather than the peace and quiet of a conference room. And depending, there would be a lot of data like, who told you this happen and when did he tell you, and how long ago did it happen, and how a play comes out on something. You know, like when it says you had a release at Fernald last week, or you read in the Washington Post that it was a release on it. That's the first you ever heard of it, there's dead meat all over. Okay. You just don't do surprises like that. So when you write a scenario, that's a reaction I had. I'll kill the son-of-a-bitch. Those things played at me reading your scenario. That's not the reality of Joe called me on Tuesday told me had a leak. Washington Post got a hold of it on Thursday. Or it happened an hour ago, the Washington Post got a hold of it. And he had given me a data dump as of 5 minutes ago. That's how it happens. And then what are you going to do. That sort of thing. Depending how you get the information and from whom plays into a scenario as to your reaction.

My initial responses probably would not, but my initial responses would rapidly come in to, would be communicated to others in DOE who would significantly influence how the ultimate decisions came out. Not only within DOE actually, but also very often the Congressional people would be involved. There would be an awful lot of interfacing to do with other organizations. There'd be an awful lot of, there is always an awful lot of inertia in the system to getting decisions made. Now with SEN-15, any decision we made we'd have to do NEPA on it. There's an awful lot of time and inertia involved and other people involved. So, in the real world, my initial responses probably would be similar to what I described, but in the final analysis, how things came out might be quite different.

I honestly don't know. I probably would have fumbled around just as much as I did here. And some of my responses kind of reflect some of stuff that may have happened in the real world. So some of them are kind of what might have happened if you, for instance, SIS was always claiming to do things that it never, it can never do. So.

Additional Comments:

none.

It was interesting. It was a very interesting exercise and I enjoyed it.

The only additional comments, hey I enjoyed it. But the only thing is, as we've talked, it's how far do you go with these things. You could have played any one of these exercises for hours if you went down all the paths and all the things you might hope to get at, to say nothing of some of them are sufficiently challenging that to sit and try to give you a 15 or 20 minute dissertation on the thing would be quite different in the real-world. From the stand point I can envision if you sat down to face some of these things and you were sitting around the table with your directors trying to strategize as to how to do it--soliciting some of their input--How in the hell are we going to assure that we're properly represented in exercise 5 on that task force. What are they really after? There would be a lot more to it than would ever come out in these conversations.

No. I thought it was a really good, really interesting, and I wanted to tell you that doing it with people who were really there is an excellent thing to do. Because we, the people who were there, looking back on it several years later, I guess a year it's not all that long, but a year later, it was good for me to think about it. And there's enough perspective on it a year later to be able to make some judgements. I think if you came and asked the question today about how we're dealing with WIPP and how we're making the decisions today, I would probably be a lot more uncomfortable giving you the answer, because I kind of don't know because we're in the middle of it. And also I wouldn't have perspective on it. I have some perspective on these. So I think I can give a better answer on what would have been better to do. In some cases than what we really did. It's great. I really would love to see the end.

The other thing is that, I guess, when you, other than the time I was in Washington my entire experience has been in the field where you've got the rubber meeting the road. And where I believe where most of the decisions are made, or should be made. I think you'd have to stretch very, very hard to find out where decisions are being made in response to these kinds of things in a Washington arena. Most of the things that they're doing is preparing the strategic plans, where are we going, how are we going to get there, go defend the budget. Working that process of where do I want to go, and how do I want to get there, rather than reacting to stimuli or other things. Yeah they react to it but there's nothing they can do with that. Most of their business is trying to defend and get things going. Whether you run a reactor for plutonium or tritium basically is a decision that's made in the field with information going on to Washington.

VITA

R. Martin Jones was born on June 23, 1952 to Dr. Arthur H. Jones, Jr. and Rosemary Jones. He earned his Bachelor of Arts degree from Emory and Henry College in 1974 with a double major in Physics and Music. Martin continued in academics earning his Master of Science in Nuclear Science and Engineering in 1976 from Virginia Polytechnic Institute and State University. He continued to take courses in Nuclear Science and Engineering after completing his Master of Science degree. Martin left academics in 1976 to establish Energy Conservation and Management, Inc. Martin was co-founder and president of Energy Conservation and Management, Inc. which was established to market energy conservation products and consulting services to industry. In 1977, Martin went to work for the Tennessee Valley Authority as an engineer in the Office of Power's Division of Fuels Systems Development Group. Martin returned to Blacksburg, Virginia and Virginia Polytechnic Institute and State University in 1981 to help establish the Management Systems Laboratories within the Industrial and Systems Engineering Department. After completion of his Doctor of Philosophy degree in Nuclear Science and Engineering, Martin plans to continue his endeavors with the Management Systems Laboratories.